


**Kongunadu College of Engineering and Technology (Autonomous)**  
**Affiliated to Anna University, Chennai**  
**B.E. Electrical and Electronics Engineering**  
**Regulations: R2024**  
**Choice Based Credit System**  
**(Applicable for the students admitted from 2024-25 onwards)**

Semester – I								
S. No.	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1	24MC001	Induction Programme	MC	-	-	-	-	0
<b>Theory</b>								
2	24EN101	Communicative English	HSMC	3	0	0	3	3
3	24MA101	Matrices and Calculus	BSC	3	1	0	4	4
4	24PH101	Engineering Physics	BSC	3	0	2	5	4
5	24CY101	Engineering Chemistry	BSC	3	0	2	5	4
6	24GE102	Engineering Graphics	ESC	3	0	2	5	4
7	24TA101	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
<b>Practicals</b>								
8	24GE104L	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	24EEC101L	Interpersonal Communication Laboratory	EEC	0	0	2	2	1
<b>Total</b>				<b>16</b>	<b>1</b>	<b>12</b>	<b>29</b>	<b>23</b>

Semester – II								
S. No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24EN201	Technical English	HSMC	3	0	0	3	3
2	24MA202	Vector Calculus and Numerical Analysis	BSC	3	1	0	4	4
3	24MC002	Universal Human Values – 2 Understanding Harmony	HSMC	2	1	0	3	3
4	24CY201	Environmental Sciences	BSC	3	0	0	3	3

  
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5	24GE101	Computer Fundamentals and C Programming	ESC	3	0	0	3	3
6	24EE201	Circuit Theory	PCC	3	1	0	4	4
7	24TA201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1	1
<b>Practicals</b>								
8	24GE103L	C Programming Laboratory	ESC	0	0	3	3	1.5
9	24EE202L	Electric Circuits Laboratory	PCC	0	0	3	3	1.5
10	24EEC201L	Professional Communication Laboratory	EEC	0	0	2	2	1
<b>Total</b>				<b>18</b>	<b>3</b>	<b>8</b>	<b>29</b>	<b>25</b>

Semester – III								
S. No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24MA303	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	24EE301	Electromagnetic Theory	PCC	3	0	0	3	3
3	24EC303	Digital Electronics	PCC	3	0	0	3	3
4	24EE302	Electron Devices and Circuits	PCC	3	0	0	3	3
5	24EE303	DC Machines and Transformers	PCC	3	0	0	3	3
6	24CS302	Object Oriented Programming using Java	ESC	3	0	2	5	4
<b>Practicals</b>								
7	24EE305L	Electron Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
8	24EE306L	DC Machines and Transformers Laboratory	PCC	0	0	3	3	1.5
9	24EEC301L	Soft Skills Development	EEC	0	0	2	2	1
<b>Total</b>				<b>18</b>	<b>1</b>	<b>10</b>	<b>29</b>	<b>24</b>

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Semester – IV								
S. No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24MA405	Statistics and Numerical Methods	BSC	3	1	0	4	4
2	24EE401	Synchronous and Induction Machines	PCC	3	0	0	3	3
3	24EE402	Control Systems	PCC	3	0	0	3	3
4	24EE403	Transmission and Distribution	PCC	3	0	0	3	3
5	24EC402	Linear Integrated Circuits and Applications	PCC	3	0	0	3	3
6	24MC003	Constitution of India	MC	2	0	0	2	0
<b>Practicals</b>								
7	24EE404L	Synchronous and Induction Machines Laboratory	PCC	0	0	3	3	1.5
8	24EC411L	Linear and Digital Circuits Laboratory	PCC	0	0	3	3	1.5
9	24EEC401L	Life Skills and Personality Development	EEC	0	0	2	2	1
<b>Total</b>				<b>17</b>	<b>1</b>	<b>8</b>	<b>26</b>	<b>20</b>

Semester – V								
S. No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24EE501	Power System Analysis	PCC	3	0	0	3	3
2	24EE502	Power Electronics	PCC	3	0	0	3	3
3	24EE503	Measurements and Instrumentation	PCC	2	0	2	4	3
4	24EC401	Microprocessors and Microcontrollers	PCC	3	0	0	3	3
5		Professional Elective – I	PEC	3	0	0	3	3
6		Open Elective – I	OEC	3	0	0	3	3
<b>Practicals</b>								
7	24EE504L	Power Electronics Laboratory	PCC	0	0	3	3	1.5

  
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8	24EC404L	Microprocessor and Microcontroller Laboratory	PCC	0	0	3	3	1.5
9	24EE505L	Mini Project – I	EEC	0	0	2	2	1
10	24EEEC501L	Professional Skills and Career Development	EEC	0	0	2	2	1
<b>Total</b>				<b>17</b>	<b>0</b>	<b>12</b>	<b>29</b>	<b>23</b>

Semester – VI								
S.No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24EE601	Power System Operation and Control	PCC	3	0	0	3	3
2	24EE602	Power System Protection and Switchgear	PCC	3	0	0	3	3
3		Professional Elective – II	PEC	3	0	0	3	3
4		Professional Elective – III	PEC	3	0	0	3	3
5		Open Elective – II	OEC	3	0	0	3	3
<b>Practicals</b>								
6	24EE603L	Power System Simulation Laboratory	PCC	0	0	4	4	2
7	24EE604L	Mini Project – II	EEC	0	0	2	2	1
8	24EEEC601L	Employability Skills	EEC	0	0	2	2	1
<b>Total</b>				<b>15</b>	<b>0</b>	<b>8</b>	<b>23</b>	<b>19</b>


Semester – VII								
S.No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1	24EE701	Industrial Automation and Process Control	PCC	3	0	0	3	3
2	24ME705PE	Total Quality Management	HSMC	3	0	0	3	3
3	24EE702	Renewable Energy Systems	PCC	3	0	0	3	3

  
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4		Professional Elective – IV	PEC	3	0	0	3	3
5		Professional Elective – V	PEC	3	0	0	3	3
<b>Practicals</b>								
6	24EE703L	Industrial Automation Laboratory	PCC	0	0	3	3	1.5
7	24EE704L	Renewable Energy Systems Laboratory	PCC	0	0	3	3	1.5
<b>Total</b>				<b>15</b>	<b>0</b>	<b>6</b>	<b>21</b>	<b>18</b>

Semester – VIII								
S. No.	Course Code	Course Title	Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
<b>Theory</b>								
1		Professional Elective – VI	PEC	3	0	0	3	3
2		Professional Elective – VII	PEC	3	0	0	3	3
<b>Practical</b>								
3	24EE801L	Project Work	EEC	0	0	20	20	10
<b>Total</b>				<b>6</b>	<b>0</b>	<b>20</b>	<b>26</b>	<b>16</b>

**Total Credits: 168**

  
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### Professional Elective Courses: Verticals

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI	Vertical VII	Vertical VIII (Other Programmes only)
<b>Power Engineering</b>	<b>Power Converters and Drives</b>	<b>Embedded Systems and Industrial IoT</b>	<b>Electric Vehicle Technology</b>	<b>Artificial Intelligence for Electrical Engineering</b>	<b>Sustainable Energy Technologies</b>	<b>Diversified Courses</b>	<b>Electrical Engineering</b>
EHVAC Transmission System	Multilevel Power Converters	Embedded Processors	Electric Vehicle Architecture	Artificial Intelligence in Electrical Engineering	Power Plant Engineering	Soft Computing Techniques	Basics of Electrical Circuits
Power System Security	Special Electrical Machines	Programming for Embedded Systems	Design of Motor and Power Converters for Electric Vehicles	Data Science for Electrical Engineers	Fuel Cell Technology	Industrial Automation and Modern Control Systems	Fundamentals of Analog and Digital Electronics
Restructured Power System	Design of Electrical Machines	Embedded Control for Electrical Drives	Testing of Electric Vehicles	Data Warehousing and Data Mining	Energy Conservation in Electrical Systems	PLC Programming	Electrical Machines
HVDC Power Transmission Systems	SMPS and UPS	Sensors for IoT Applications	Grid Integration of Electric Vehicles	Artificial Neural Networks and Applications	Biomass Conversion and Biorefinery	Digital Signal Processing	Measurements and Control
High Voltage Engineering	Solid State Drives	IoT and its Applications	Intelligent Control of Electric Vehicles	Fuzzy Logic Control	Wind Energy Technology	Intellectual Property Rights	Fundamentals of Power Electronics
Substation Design and Automation	Power Electronics Applications in Power Systems	IoT for System Design	Battery Management System	Machine Learning for Engineering and Science Applications	Energy Storage Devices	Operation and Planning of Power Distribution Systems	Microprocessors and Applications
Smart Grid: Basics to Advanced Technologies	Analysis of Electrical Machines	Introduction to Embedded System Design	Hybrid and Electric Vehicle Technology	Augmented Reality/Virtual Reality	Utilization and Conservation of Electrical Energy	Energy Conservation and Waste Heat Recovery	Power Systems
Power Quality	Advanced Electrical Drives	Introduction to Industry 4.0 and Industrial Internet of Things	IoT for Electric Vehicle Applications	Robotics Process Automation	Solar Energy Engineering and Technology	Industrial Electrical Safety	Utilization of Electrical Energy
							Automation and Control
							Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems

  
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### Registration of professional Elective Courses from Verticals:

- Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row.
- The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also.

### PROFESSIONAL ELECTIVE COURSES: VERTICALS

#### VERTICAL I: POWER ENGINEERING

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE101PE	EHVAC Transmission System	PEC	3	0	0	3	3
2.	24EE102PE	Power System Security	PEC	3	0	0	3	3
3.	24EE103PE	Restructured Power System	PEC	3	0	0	3	3
4.	24EE104PE	HVDC Power Transmission Systems	PEC	3	0	0	3	3
5.	24EE105PE	High Voltage Engineering	PEC	3	0	0	3	3
6.	24EE106PE	Substation Design and Automation	PEC	3	0	0	3	3
7.	24EE107PE	Smart Grid: Basics to Advanced Technologies	PEC	3	0	0	3	3
8.	24EE108PE	Power Quality	PEC	3	0	0	3	3

**VERTICAL II: POWER CONVERTERS AND DRIVES**

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE201PE	Multilevel Power Converters	PEC	3	0	0	3	3
2.	24EE202PE	Special Electrical Machines	PEC	3	0	0	3	3
3.	24EE203PE	Design of Electrical Machines	PEC	3	0	0	3	3
4.	24EE204PE	SMPS and UPS	PEC	3	0	0	3	3
5.	24EE205PE	Solid State Drives	PEC	3	0	0	3	3
6.	24EE206PE	Power Electronics Applications in Power Systems	PEC	3	0	0	3	3
7.	24EE207PE	Analysis of Electrical Machines	PEC	3	0	0	3	3
8.	24EE208PE	Advanced Electrical Drives	PEC	3	0	0	3	3

**VERTICAL III: EMBEDDED SYSTEMS AND INDUSTRIAL IOT**

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EC602PE	Embedded Processors	PEC	3	0	0	3	3
2.	24EC603PE	Programming for Embedded Systems	PEC	3	0	0	3	3
3.	24EE301PE	Embedded Control for Electrical Drives	PEC	3	0	0	3	3
4.	24EC606PE	Sensors for IoT Applications	PEC	3	0	0	3	3
5.	24EC501	IoT and its Applications	PEC	3	0	0	3	3
6.	24EE302PE	IoT for System Design	PEC	3	0	0	3	3
7.	24EE303PE	Introduction to Embedded System Design	PEC	3	0	0	3	3

8.	24EE304PE	Introduction to Industry 4.0 and Industrial Internet of Things	PEC	3	0	0	3	3
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#### VERTICAL IV: ELECTRIC VEHICLE TECHNOLOGY

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE401PE	Electric Vehicle Architecture	PEC	3	0	0	3	3
2.	24EE402PE	Design of Motor and Power Converters for Electric Vehicles	PEC	2	0	2	4	3
3.	24EE403PE	Testing of Electric Vehicles	PEC	2	0	2	4	3
4.	24EE404PE	Grid Integration of Electric Vehicles	PEC	3	0	0	3	3
5.	24EE405PE	Intelligent Control of Electric Vehicles	PEC	3	0	0	3	3
6.	24EE406PE	Battery Management System	PEC	3	0	0	3	3
7.	24ME802PE	Hybrid and Electric Vehicle Technology	PEC	3	0	0	3	3
8.	24EE407PE	IoT for Electric Vehicle Applications	PEC	3	0	0	3	3

#### VERTICAL V: ARTIFICIAL INTELLIGENCE FOR ELECTRICAL ENGINEERING

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE501PE	Artificial Intelligence in Electrical Engineering	PEC	3	0	0	3	3
2.	24EE502PE	Data Science for Electrical Engineers	PEC	3	0	0	3	3
3.	24AD302PE	Data Warehousing and Data Mining	PEC	3	0	0	3	3
4.	24EE503PE	Artificial Neural Networks and Applications	PEC	3	0	0	3	3

5.	24EE504PE	Fuzzy Logic Control	PEC	3	0	0	3	3
6.	24CS702PE	Machine Learning for Engineering and Science Applications	PEC	3	0	0	3	3
7.	24CS601PE	Augmented Reality/Virtual Reality	PEC	3	0	0	3	3
8.	24AD601PE	Robotics Process Automation	PEC	3	0	0	3	3

#### VERTICAL VI: SUSTAINABLE ENERGY TECHNOLOGIES


S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24ME106PE	Power Plant Engineering	PEC	3	0	0	3	3
2.	24EE601PE	Fuel Cell Technology	PEC	3	0	0	3	3
3.	24EE602PE	Energy Conservation in Electrical Systems	PEC	3	0	0	3	3
4.	24EE603PE	Biomass Conversion and Biorefinery	PEC	3	0	0	3	3
5.	24EE604PE	Wind Energy Technology	PEC	2	0	2	4	3
6.	24ME103PE	Energy Storage Devices	PEC	3	0	0	3	3
7.	24EE605PE	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3
8.	24EE606PE	Solar Energy Engineering and Technology	PEC	3	0	0	3	3

**VERTICAL VII: DIVERSIFIED COURSES**

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE701PE	Soft Computing Techniques	PEC	3	0	0	3	3
2.	24EE702PE	Industrial Automation and Modern Control Systems	PEC	3	0	0	3	3
3.	24EE703PE	PLC Programming	PEC	3	0	0	3	3
4.	24EC502	Digital Signal Processing	PEC	3	0	0	3	3
5.	24EE704PE	Intellectual Property Rights	PEC	3	0	0	3	3
6.	24EE705PE	Operation and Planning of Power Distribution Systems	PEC	3	0	0	3	3
7.	24EE706PE	Energy Conservation and Waste Heat Recovery	PEC	3	0	0	3	3
8.	24EE707PE	Industrial Electrical Safety	PEC	3	0	0	3	3

**VERTICAL VIII: ELECTRICAL ENGINEERING**

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24EE801PE	Basics of Electrical Circuits	PEC	2	0	2	4	3
2.	24EE802PE	Fundamentals of Analog and Digital Electronics	PEC	3	0	0	3	3
3.	24EE803PE	Electrical Machines	PEC	3	0	0	3	3
4.	24EE804PE	Measurements and Control	PEC	2	0	2	4	3
5.	24EE805PE	Fundamentals of Power Electronics	PEC	3	0	0	3	3
6.	24EE806PE	Microprocessors and Applications	PEC	2	0	2	4	3

  
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7.	24EE807PE	Power Systems	PEC	3	0	0	3	3
8.	24EE808PE	Utilization of Electrical Energy	PEC	3	0	0	3	3
9.	24EE809PE	Automation and Control	PEC	3	0	0	3	3
10.	24EE810PE	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	PEC	3	0	0	3	3

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**Open Elective Course (OEC)**

**(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)**

**Semester-V  
Open Elective-I**

S. No.	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24AD101OE	Introduction to Artificial Intelligence	OEC	3	0	0	3	3
2.	24AD102OE	Introduction to Data Science	OEC	3	0	0	3	3
3.	24AG101OE	Basics of Agriculture Engineering	OEC	3	0	0	3	3
4.	24AG102OE	Farm Machinery	OEC	3	0	0	3	3
5.	20BM101OE	Medical Instruments	OEC	3	0	0	3	3
6.	24BM102OE	Food, Nutrition and Health	OEC	3	0	0	3	3
7.	24CE101OE	Industrial Waste Management	OEC	3	0	0	3	3
8.	24CE102OE	Ecological Engineering	OEC	3	0	0	3	3
9.	24CS101OE	Python Programming for Data Science	OEC	3	0	0	3	3
10.	24CS102OE	Programming and Data Structures	OEC	3	0	0	3	3
11.	24EC101OE	Principles of Signal Processing	OEC	3	0	0	3	3
12.	24EC102OE	Consumer Electronics	OEC	3	0	0	3	3
13.	24ME101OE	Production Technology	OEC	3	0	0	3	3
14.	24ME102OE	Alternative Energy Fuels	OEC	3	0	0	3	3
15.	24IT101OE	Fundamentals of Software Engineering	OEC	3	0	0	3	3
16.	24IT102OE	Wireless Sensor Networks	OEC	3	0	0	3	3

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**Semester-VI**  
**Open Elective-II**

S. No.	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24AD201OE	Basics of Visualization Tools	OEC	3	0	0	3	3
2.	24AD202OE	Foundations of Machine Learning	OEC	3	0	0	3	3
3.	24AG201OE	Introduction to Organic Farming	OEC	3	0	0	3	3
4.	24AG202OE	Introduction to Green House Technology	OEC	3	0	0	3	3
5.	20BM201OE	Traditional Indian Foods	OEC	3	0	0	3	3
6.	24BM202OE	Fundamentals of Cell and Molecular Biology	OEC	3	0	0	3	3
7.	24CE201OE	Global Warming and Climate Change	OEC	3	0	0	3	3
8.	24CE202OE	Building Services	OEC	3	0	0	3	3
9.	24CS201OE	Fundamentals of Operating Systems	OEC	3	0	0	3	3
10.	24CS202OE	Introduction to Database	OEC	3	0	0	3	3
11.	24EC201OE	Basics of Virtual Instrumentation	OEC	3	0	0	3	3
12.	24EC202OE	Telecommunications for Society	OEC	3	0	0	3	3
13.	24ME201OE	Basics of Automotive Components	OEC	3	0	0	3	3
14.	24ME202OE	Unconventional Machining Processes	OEC	3	0	0	3	3
15.	24IT201OE	Introduction to Web Development	OEC	3	0	0	3	3
16.	24IT202OE	Principles of Multimedia	OEC	3	0	0	3	3

  
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**COURSE CATEGORY SEMESTER WISE TOTAL CREDIT**

S. No	Course Category	Credits as per Semester								Total Credits	Percentage (%)
		I	II	III	IV	V	VI	VII	VIII		
1	HSMC	4	7	-	-	-	-	3	-	14	8.34
2	BSC	12	7	4	4	-	-	-	-	27	16.07
3	ESC	6	4.5	4	-	-	-	-	-	14.5	8.63
4	PCC	-	5.5	15	15	15	8	9	-	67.5	40.18
5	EEC	1	1	1	1	2	2	-	10	18	10.71
6	PEC	-	-	-	-	3	6	6	6	21	12.5
7	OEC	-	-	-	-	3	3	-	-	6	3.57
8	MC	-	-	-	-	-	-	-	-	-	0
Total		23	25	24	20	23	19	18	16	168	100

  
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### ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

- A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.
- For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.
- For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V
<b>Fintech and Block Chain</b>	<b>Entrepreneurship</b>	<b>Public Administration</b>	<b>Business Data Analytics</b>	<b>Environment and Sustainability</b>
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable Infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Elements of Public Administration	Data Mining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

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### VERTICALS FOR MINOR DEGREE

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

#### VERTICAL I: FINTECH AND BLOCK CHAIN

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24M101	Financial Management	PEC	3	0	0	3	3
2.	24M102	Fundamentals of Investment	PEC	3	0	0	3	3
3.	24M103	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	24M104	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	24M105	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	24M106	Introduction to Fintech	PEC	3	0	0	3	3

#### VERTICAL II: ENTREPRENEURSHIP

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24M201	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	24M202	Team Building and Leadership Management for Business	PEC	3	0	0	3	3
3.	24M203	Creativity and Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	24M204	Principles of Marketing Management for Business	PEC	3	0	0	3	3

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5.	24M205	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	24M206	Financing New Business Ventures	PEC	3	0	0	3	3

### VERTICAL III: PUBLIC ADMINISTRATION

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24M301	Principles of Public Administration	PEC	3	0	0	3	3
2.	24M302	Elements of Public Administration	PEC	3	0	0	3	3
3.	24M303	Public Personnel Administration	PEC	3	0	0	3	3
4.	24M304	Administrative Theories	PEC	3	0	0	3	3
5.	24M305	Indian Administrative System	PEC	3	0	0	3	3
6.	24M306	Public Policy Administration	PEC	3	0	0	3	3

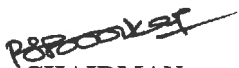
### VERTICAL IV: BUSINESS DATA ANALYTICS

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24M401	Statistics for Management	PEC	3	0	0	3	3
2.	24M402	Data Mining for Business Intelligence	PEC	3	0	0	3	3
3.	24M403	Human Resource Analytics	PEC	3	0	0	3	3
4.	24M404	Marketing and Social Media Web Analytics	PEC	3	0	0	3	3
5.	24M405	Operation and Supply Chain Analytics	PEC	3	0	0	3	3
6.	24M406	Financial Analytics	PEC	3	0	0	3	3

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**VERTICAL V: ENVIRONMENT AND SUSTAINABILITY**

S. No	Course Code	Course Title	Course Category	No. of Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	24M501	Sustainable Infrastructure Development	PEC	3	0	0	3	3
2.	24M502	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	24M503	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	24M504	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	24M505	Green Technology	PEC	3	0	0	3	3
6.	24M506	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	24M507	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	24M508	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3

  
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This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

**The induction programme has been introduced by AICTE with the following objective:**

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “ Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

**(i) Physical Activity**

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

**(ii) Creative Arts**

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

**(iii) Universal Human Values**

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don't's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

  
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**(iv) Literary Activity**

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

**(v) Proficiency Modules**

This would address some lacunas that students might have, for example, English, computer familiarity etc.

**(vi) Lectures by Eminent People**

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

**(vii) Visits to Local Area**

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

**(viii) Familiarization to Dept./Branch & Innovations**

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

**(ix) Department Specific Activities**

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science. Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

**References: Guide to Induction program from AICTE**

  
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**OBJECTIVES:**

The students should be made to:

- Develop basic communication skills in English.
- Enhance the speaking skills for academic, professional and social purposes.
- Use of the electronic media such as internet and other online resources for their language development.
- Inculcate the habit of reading and writing for the purpose of effective communication
- Develop confidence in learners to communicate in English for all purposes

**UNIT I BASICS OF COMMUNICATION 9**

Listening: Basics of listening-Intensive and Extensive Listening, Barriers to Effective Listening; Speaking: Speaking about Future plans- Giving instruction to use the product, Reading: Skimming and Scanning, Writing: Writing about one's leisure time activities, hometown, everyday activities etc., Grammar: Parts of speech, Prepositions, Vocabulary: Word formation.

**UNIT II CREATIVE COMMUNICATION 9**

Listening: Listening to short lectures /talks, Speaking: Telephonic interview, Reading: Reading Editorial and Opinion Blogs, Writing: Biographical writing - Writing a paragraph (Cause and Effect/Compare and Contrast/Narrative/Analytical) - Grammar: Gerund and Infinitive - Present Tense, Vocabulary: Abbreviations & Acronyms.

**UNIT III FUNCTIONAL COMMUNICATION 9**

Listening: Listening to radio and TV and taking notes - Focused audio tracks, Speaking: Role Play - Group Interaction, Reading: Reading magazines, Writing: Letter (Informal /Formal – Industrial Visit, Internship, etc), Writing a set of instructions, Grammar: Past Tense -Subject - Verb Agreement, Vocabulary: Question Tags.

**UNIT IV ANALYTICAL SKILLS 9**

Listening: Listening to select talks by eminent personalities, speaking: Speaking in mock Interviews, Reading: Reading advertisements, Writing: Writing a set of recommendations, Interpreting Visual Materials (Line Graphs, Pie Charts etc.), Grammar: Sentence Pattern, Future Tense, Articles, Vocabulary: Single word substitutes.

**UNIT V PROFESSIONAL COMMUNICATION 9**

Listening: Understanding different Accents, Listening to TED talks, Speaking: Giving impromptu talks- Making presentations, Reading: Reading and comprehending a passage, Writing: Letter to the editor- Check list, Grammar: Direct and Indirect Speech, Vocabulary: Phrasal Verbs.

**TOTAL: 45 PERIODS**

  
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**OUTCOMES:**

**On successful completion of the course, the students will be able to,**

- Use suitable vocabulary with confidence and express their ideas both in speech and writing.
- Write intelligibly avoiding grammatical errors, using a range of vocabulary, organizing their ideas logically on a topic.
- Speak confidently, with one or many listeners using appropriate communicative strategies.
- Read different genres of texts adopting various reading strategies.
- Understand different spoken discourses/excerpts in different accents.

**TEXT BOOKS:**

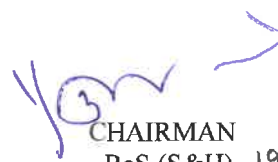
1. Kumar, Sanjay and Lata, Pushp, "Communication Skills", Oxford University Press. 2018.

**REFERENCES:**

1. DuttP. Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2007.
2. Mohan, Krishna and Banerji Meera, "Developing Communication Skills", Macmillan Publishers India Ltd., Delhi: 2009.
3. Martin Hewings "Advanced English Grammar: A self study reference and Practice book for advanced South Asian students" Cambridge University Press, Delhi: 2016.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	-	2	-	1	2	3	-	2
CO2	-	-	2	-	2	-	-	2	3	1	-
CO3	-	-	2	-	2	1	2	3	3	2	2
CO4	-	-	-	2	2	1	2	3	3	2	2
CO5	2	3	-	2	3	-	2	-	3	1	2

  
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**OBJECTIVES:**

The students should be made to:

- Introduce the matrix techniques and to illustrate the nature of the matrix.
- Remember the basic concepts of solving algebraic and transcendental equations.
- Apply the formula for the curvature of a curve defined in Cartesian coordinates.
- Analyze the Partial differentiation, concept of total derivative, finding maxima and minima of function of two variables.
- Evaluate the techniques of integration in finding area and volume.

**UNIT I MATRICES**

9+3

Eigenvalues and eigenvectors of a real matrix - Properties of eigenvalues and eigenvectors - Cayley-Hamilton theorem (Without proof) - Application of Cayley - Hamilton theorem ( $A^{-1}, A^n$ )- Nature of quadratic forms - Reduction of a quadratic form to canonical form by orthogonal transformation.

**UNIT II SYSTEM OF LINEAR EQUATIONS**

9+3

Newton Raphson method- Bisection Method -Solution of linear system of equations by matrix method, Gauss-Jordan, Gauss- Jacobi and Gauss-Seidel methods- Eigen values of a matrix by Power method.

**UNIT III DIFFERENTIAL CALCULUS**

9+3

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normal.

**UNIT IV FUNCTIONS OF SEVERAL VARIABLES**

9+3

Partial derivatives - Total derivative - Differentiation of implicit functions - Jacobians - Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

**UNIT-V MULTIPLE INTEGRALS IN CARTESIAN COORDINATES**

9+3

Double integration- Change of order of integration- Area between two curves- Triple integration- Volume as triple integrals.

**TOTAL: (45+15) PERIODS**

**OUTCOMES:**

On successful completion of the course, the students will be able to,

- Develop problem-solving skills using systems of equations and matrix transformations.
- Evaluate the efficiency of numerical methods based on the number of iterations required to achieve a desired level of accuracy.
- Compute the radius of curvature and interpret its significance for different types of curves.
- Expand a given function into a series and determine the maximum and minimum of multivariate functions.
- Apply the concepts of double and triple integrals in mathematical and real-world contexts.

  
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**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2017.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2018.

**REFERENCES:**

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2018.
2. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2021.
3. Ramana B V "Higher Engineering Mathematics", New Delhi Tata McGraw- Hill Education India Private Limited., 2021
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" 7<sup>th</sup> Edition, Pearson Education India, 2017.

**Mapping of COs with Pos**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	3	2	2	2	-	-	-	-	-	2
<b>CO2</b>	3	3	2	3	2	-	-	-	-	-	2
<b>CO3</b>	3	3	2	2	2	1	-	-	-	-	2
<b>CO4</b>	3	3	2	3	3	1	-	-	-	-	2
<b>CO5</b>	3	2	3	3	3	2	-	-	-	-	3

  
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24PH101

**ENGINEERING PHYSICS**  
(Common to All Branches)

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**OBJECTIVES:**

**The students should be made to:**

- Recall the mechanical properties of materials.
- Gain knowledge on electrical properties of materials.
- Understand the properties of magnetic and superconducting materials.
- Examine basic quantum mechanical concepts and their applications.
- Acquire the basic knowledge about nano phase materials and their properties.

**UNIT I MECHANICAL PROPERTIES OF SOLIDS 9**

Elasticity and Plasticity - stress-strain diagram and its uses - Hooke's law - factors affecting elastic modulus - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment – I shaped girders and its applications.

**UNIT II ELECTRICAL PROPERTIES OF MATERIALS 9**

Classical free electron theory of metals - Electrical conductivity and thermal conductivity of metals - Wiedemann - Franz law - Failures of classical free electron theory - Success of Quantum free electron theory - Fermi distribution function and its variation with temperature - Density of energy states-carrier concentration of metals.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9**

Classification of magnetic materials - Domain theory of ferromagnetism - Hysteresis - Soft and Hard magnetic materials - Superconducting materials – Meissner effect - Isotopic effect - BCS theory of superconductors - Type I & Type II superconductors - Applications of superconductors.

**UNIT IV QUANTUM PHYSICS 9**

Black body radiation - Planck's theory (derivation) - Deduction of Wien's displacement law and Rayleigh Jeans' Law from Planck's theory-de-Broglie wavelength - Properties of matter waves - Schrodinger's wave equations - Time independent and time dependent wave equations - Physical significance of wave function - Particle in a one dimensional potential box.

**UNIT V NEW ENGINEERING MATERIALS 9**

Metallic glasses - Types - Preparation - Properties and applications - Shape Memory Alloys (SMA) - Characteristics and applications - Advantages and disadvantages of shape memory alloys - Synthesis of nanomaterials - Top down approaches (Ball Milling) and Bottom up approaches (CVD and PVD).

**TOTAL: 45 PERIODS**

  
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## LIST OF THE EXPERIMENTS – PHYSICS LABORATORY

1. Determination of Young's modulus of the material by Non-uniform bending method.
2. Determination of Rigidity modulus of the wire using Torsion Pendulum.
3. Determination of band gap energy of a semiconductor.
4. Determination of thickness of the thin film/wire by forming the fringe using Air wedge method.
5. Determination of velocity of ultrasonic waves in a liquid and compressibility of liquid using ultrasonic Interferometer.

**TOTAL: 30 PERIODS**

### OUTCOMES:

**On successful completion of the course, the students will be able to,**


- Identify the mechanical properties of materials and their significance in engineering applications.
- Interpret the electrical properties of materials and their role in various technological applications.
- Illustrate the magnetic and superconducting properties of materials and their practical implications.
- Apply fundamental quantum mechanical concepts to understand material behavior at the atomic level.
- Explore the properties and applications of smart materials in modern engineering solutions.

### TEXT BOOKS:

1. M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy "A Text book of Engineering Physics", S.Chand and Company Ltd, New Delhi, 11<sup>th</sup> Edition.2022.
2. Rajendran. V. "Materials Science", McGraw Hill Education (India) Private Limited, New Delhi, 2017.
3. S.O Pillai, "Solid State Physics" New Age International Publishers, New Delhi,10<sup>th</sup> Edition, 2022.


### REFERENCES:

1. R. K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai Publications, New Delhi, Reprint 2022.
2. Wahab. M.A, "Solid State Physics' Narosa Publishing House, New Delhi, 4<sup>th</sup> Edition. 2023.
3. D. Halliday, R. Resnick and J. Walker, Principles of Physics, Wiley (11<sup>th</sup> Edition), 2020.
4. Malik.K and Singh. A.K, "Engineering Physics" TMH, New Delhi 2<sup>nd</sup> Edition - 2020.

  
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**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS  
PHYSICS LABORATORY**

<b>S.No.</b>	<b>Name of Equipment</b>	<b>Quantity Required</b>
1	Torsional pendulum with accessories	6 Nos.
2	Non - Uniform bending with accessories	6 Nos.
3	Ultrasonic interferometer.	6 Nos.
4	Air wedge with accessories	6 Nos.
5	Band gap kit	6 Nos.

  
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**Mapping of COs with POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>CO1</b>	3	2	3	1	1	-	-	-	-	-	1
<b>CO2</b>	3	2	2	3	2	-	-	-	-	-	2
<b>CO3</b>	3	3	2	3	2	1	-	-	-	-	-
<b>CO4</b>	3	2	2	3	3	-	-	-	-	-	2
<b>CO5</b>	2	2	2	2	2	2	-	-	-	-	3

  
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**OBJECTIVES:**

**The student should be made to:**

- Gain knowledge on various sources of water and its industrial applications.
- Explore the essentials of electrochemistry, types of corrosion and its prevention.
- Examine the fundamentals of polymer, various engineering plastics and composites.
- Study the concept of Phase diagrams, different types of energy storage devices and emerging batteries.
- Assess the types of fuels and its quality estimation.

<b>UNIT I</b>	<b>WATER TECHNOLOGY</b>	<b>9</b>
Sources of water - Hard and soft water - Boiler feed water-requirements - disadvantages of using hard water in boilers (Scale, Sludge, Caustic Embrittlement, Priming and Foaming) - Municipal water treatment (screening, sedimentation, coagulation, filtration and disinfection - ozonolysis, UV treatment, chlorination). Internal conditioning (Phosphate, Calgon, Colloidal and Carbonate conditioning methods) - External conditioning - Zeolite and demineralization process - desalination by reverse osmosis.		
<b>UNIT II</b>	<b>ELECTROCHEMISTRY AND CORROSION SCIENCE</b>	<b>9</b>
Electrochemistry - Nernst equation & its Applications - Electrochemical (EMF) series - Corrosion - Types - Chemical and Electrochemical corrosions - Galvanic corrosion - Differential aeration corrosion - Pitting corrosion - Corrosion control - material selection and design - sacrificial anodic method and impressed current cathodic protection method - Organic coatings - Paint and its constituents.		
<b>UNIT III</b>	<b>POLYMERS AND COMPOSITES</b>	<b>9</b>
Introduction: Functionality - degree of polymerization. Classification of polymers (Source, Structure, Synthesis and Intermolecular forces) - Mechanism of free radical polymerization - Engineering Plastics: Polyamides, Polycarbonates and Polyurethanes. Composites: Need, Composition of composites - Definition, examples and applications of Metal matrix composites (MMC), Ceramic matrix composites (CMC) and Polymer matrix composites (PMC)		
<b>UNIT IV</b>	<b>PHASE RULE AND ENERGY STORAGE DEVICES</b>	<b>9</b>
Phase Rule - Terms involved - One Component system (water system) - Two component system (Lead-Silver system) - Storage devices - types - primary battery (dry cell), secondary battery (lead acid, lithium-ion battery) - Emerging batteries - Aluminum air battery, batteries for automobiles and satellites - Fuel cells - Hydrogen - Oxygen fuel cell.		
<b>UNIT V</b>	<b>FUELS AND COMBUSTION</b>	<b>9</b>
Fuels - Introduction - Classification of fuels - coal - Analysis of coal (proximate and ultimate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method) - Petroleum - Manufacture of synthetic petrol (Bergius process) - Knocking - Anti knocking - Octane number - Cetane number - Gaseous fuels - LPG, CNG - Combustion: Calorific value - higher and lower calorific values - Theoretical calculation of calorific value - Flue gas analysis (ORSAT Method).		

**TOTAL: 45 PERIODS**

  
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## LIST OF THE EXPERIMENTS - CHEMISTRY LABORATORY

1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of Chloride content of water sample by Argentometric method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of Copper content by spectrophotometer.
6. Estimation of iron content of the given solution using potentiometer.
7. Conductometric titration of strong acid Vs strong base.

**TOTAL: 30 PERIODS**

### OUTCOMES:

**On successful completion of the course, the students will be able to,**

- Understand the various water treatment methodologies and its applications.
- Recognize corrosion protection techniques and appropriate mitigation strategies.
- Assess different types of polymers, composites and their industrial applications.
- Illustrate the concept of phase diagram, working principles of batteries, emerging energy storage technologies and their applications.
- Analyze the various fuels and their properties.

### TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing, Company, New Delhi, 2015.
2. S. S. Dara, "A Text Book of Engineering Chemistry", Chand & Co. Ltd., New Delhi, 2013.

### REFERENCES:

1. Shika Agarwal, "Engineering Chemistry", Cambridge University Press, Delhi, 2016.
2. B. Sivashankar, "Engineering Chemistry", Tata Mc. Graw-Hill Publishing Company, Ltd., Delhi, 2012.
3. G Palanna, "Engineering Chemistry", Tata Mc. Graw Hill Education Private Limited, Delhi, 2017.
4. Prasanta Rath, "Engineering Chemistry", Cengage Learning India Pvt. Ltd., Delhi, 2018.

  
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**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS  
CHEMISTRY LABORATORY**

<b>S.No.</b>	<b>Name of Equipment</b>	<b>Quantity Required</b>
1	pH Meter	10 Nos.
2	Digital Conductivity Meter	10 Nos.
3	Digital Potentiometer	10 Nos.
4	Electronic Balance	5 Nos.
5	Deionizer unit	1 No.
6	Spectrophotometer	5 Nos.

  
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**Mapping of COs with POs**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>CO1</b>	3	2	2	-	2	3	2	-	-	-	-
<b>CO2</b>	3	2	-	-	2	3	2	-	-	-	-
<b>CO3</b>	3	-	2	2	3	2	-	-	-	-	-
<b>CO4</b>	3	2	1	-	3	2	-	-	-	-	2
<b>CO5</b>	3	3	1	-	2	3	2	-	-	-	2

  
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**OBJECTIVES:****The student should be made to:**

- Understand the various basic concepts like dimensioning, standards, curves and free hand sketching
- Develop the skills on projection of points, lines and plane surfaces
- Impart knowledge on projection of solids like prisms and pyramids
- Illustrate the section of solids and development of surfaces for various objects
- Acquire skills on viewing of solid objects in Isometric and Perspective projections

**CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)**

2

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and geometric dimensioning

**UNIT I PLANE CURVES AND FREE HAND SKETCHING**

9+6

Curves used in engineering practices: Conics - Construction of ellipse, Parabola and hyperbola by eccentricity method - Construction of cycloid and involutes of square and circle- Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles - Representation of Three Dimensional objects - Layout of views – Free hand sketching of multiple views from pictorial views of objects.

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**

9+6

Projection of points - Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true length and true inclination by rotating line method - Projection of planes inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS**

7+6

Projection of simple solids like prisms, pyramids, cylinder, cone when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

9+6

Sectioning of solids: prisms, pyramids, cylinder, cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids: prisms, pyramids, cylinder and cone.

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**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**

9+6

Principles of isometric projection - isometric scale - isometric projections of simple solids, truncated and frustum of solids: Prisms, pyramids, cylinder, cone - Perspective projection of simple solids: Prisms, pyramids and cylinder by visual ray method.

**TOTAL: 75 (45+30) PERIODS****OUTCOMES:**

On successful completion of this course, the students will be able to,

- Relate the engineering knowledge on dimensioning, standards, curves and free hand sketching objects
- Identify the various views on the projection of points, straight lines and plane surfaces
- Apply the knowledge on projection of solids like prisms and pyramids
- Analyze the section of solids and development of surfaces
- Develop the isometric views and perspective projection of simple solids

**TEXT BOOKS:**

1. Natarajan K V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2023.
2. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2024.

**REFERENCES:**

1. Bhatt N D and Panchal V M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2023.
2. Basant Agarwal and Agarwal C M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2019.
3. Gopalakrishna K R., "Engineering Drawing" (Vol. I & II combined), Subhas Stores, Bangalore, 2017.

**Special points applicable to End Semester Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use an appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	3	-	2
CO2	3	2	2	-	-	-	-	-	3	-	2
CO3	3	2	2	-	-	-	-	-	3	-	2
CO4	3	2	2	-	-	-	-	-	3	-	2
CO5	3	2	2	-	-	-	-	-	3	-	2

  
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24TA101

**HERITAGE OF TAMILS**  
(Common to All Branches)

**L T P C**  
**1 0 0 1**

**OBJECTIVES:**

The students should be made to:

- Learn the extensive literature of classical Tamil.
- Analyze rock art paintings to modern art.
- Understand folk and martial arts.
- Apply the concepts of Thinaï in Tamils.
- Realize the contribution of Tamils in Indian freedom struggle.

**UNIT I LANGUAGE AND LITERATURE 3**

Language Families in India - Dravidian Languages –Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART- SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yash and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India– Self-Respect Movement- Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL: 15 PERIODS**

  
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## OUTCOMES:

On successful completion of the course, the students will be able to,

- Recognize the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Realization of Thinai concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self- esteem movement and siddha medicine.

## TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சந்திரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருறை - ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatananian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : Internatuonal Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	2	-	1
CO2	-	-	-	-	-	-	2	1	2	-	1
CO3	-	-	-	-	-	-	2	1	2	-	1
CO4	-	-	-	-	-	-	2	1	2	-	1
CO5	-	-	-	-	-	-	2	1	2	-	1

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**நோக்கங்கள்:****மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன:**

- செம்மொழியான தமிழ் மொழியின் விரிவான இலக்கியத்தைப் பற்றி அறிதல்.
- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை உள்ள கலைகளை பகுப்பாய்வு செய்தல்.
- நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகளைப் புரிந்துகொள்ளுதல்.
- தமிழர்களின் திணைக் கோட்பாடுகளைச் செயல்படுத்துதல்.
- இந்திய விடுதலைப் போராட்டத்திற்கும் பண்பாட்டிற்கும் தமிழர்களின் பங்களிப்பை உணருதல்

**அலகு 1 மொழி மற்றும் இலக்கியம்**

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம்-திருக்குறளில் மேலாண்மைக் கருத்துக்கள்- தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பெளத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் -தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை**

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை , வீணை , யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்**

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள்

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போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் -சங்ககால நகரங்களும் துறை முகங்களும் -சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்புகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**TOTAL: 15 PERIODS**


**முடிவுகள்:**

**பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:**

- தமிழ் மொழியின் செம்மொழி தன்மையையும் சங்க இலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்துகொள்வார்கள்.
- நாட்டுப்புறக் கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக் கோட்பாடுகளும் சங்ககால வர்த்தகமும் புரிந்துகொள்வார்கள்.
- இந்திய விடுதலைப் போராட்டம், சுயமரியாதை இயக்கம், சித்த மருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

**உரை மற்றும் குறிப்பு புத்தகங்கள்:**


1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
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8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)

  
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9. Keeladi – ‘Sangam City Civilization on the banks of the river Vaigai’ (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
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#### Mapping of COs with POs

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CO3	-	-	-	-	-	-	2	1	2	-	1
CO4	-	-	-	-	-	-	2	1	2	-	1
CO5	-	-	-	-	-	-	2	1	2	-	1

  
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**OBJECTIVES:****The student should be made to:**

- Acquire knowledge in calculation of area and volume of various 2D and 3D shapes and gain practical exposure in pipeline connections and carpentry
- Develop the fundamental skills in welding, machining, sheet metal and foundry works
- Illustrate the basic working principles of air conditioner, industrial robot and washing machine
- Learn the domestic, industrial wiring circuits and measure the electrical parameters
- Demonstrate the basic electronic components in PCB, assemble of smart phone, computer and LED TV

**GROUP A (CIVIL & MECHANICAL)****I. CIVIL ENGINEERING PRACTICES**

15

**Basic Measurements**

1. Calculation of area and volume for various solid and hollow shapes, including cubical, spherical, cylindrical and conical models with different scale conversions.

**Carpentry**

2. Study of industrial trusses and joints in doors and windows using models.
3. Sawing and planing- Making joints: T-joint, Mortise joint, and Tenon joint.

**Plumbing**

4. Laying pipe connections for suction and delivery sides of the pumps and preparation of plumbing line sketches for water supply and sewage works.
5. Connecting various pipe fittings using different materials (metal, plastic, and flexible pipes) and other components which are commonly used in household appliances.

**II. MECHANICAL ENGINEERING PRACTICES**

15

**Welding:**

- a) Arc Welding
  - i) Butt joint
  - ii) Lap joint
- b) Gas welding practice

**Basic Machining:**

- a) Turning and Facing
- b) Drilling and tapping

**Sheet Metal work:**

- a) Making of a funnel
- b) Making of a tray

**Foundry work:**

- a) Making a mould using solid pattern
- b) Making a mould using split pattern

**Study Experiments**

- a) Study of components in Air conditioner
- b) Study of components in Industrial robot
- c) Study of components in Washing machine



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## GROUP B (ELECTRICAL AND ELECTRONICS)

### III. ELECTRICAL ENGINEERING

15

1. Residential house wiring using switches, fuse, indicator, circuit breaker, lamp and Energy meter
2. Stair case wiring
3. Industrial wiring using switches, fuse, indicator and Energy meter
4. Measurement of electrical quantities - voltage, current, power, power factor and energy in RLC circuit
5. Calculation of energy consumption for different lamps
6. Study of fan with regulator, Iron Box and Emergency Lamp

### IV. ELECTRONICS ENGINEERING

15

1. Study and identification of electronic components -Resistors, Capacitors and Inductors
2. Assembling and testing electronic components in small PCB
3. Assembling and dismantling of Computer/Laptop
4. Assembling and dismantling of LED TV
5. Study of elements in smart phone

**TOTAL: 60 PERIODS**


#### OUTCOMES:

On successful completion of this course, the students will be able to,

- Interpret engineering knowledge on calculation of area and volume of different geometric shapes, connecting various household fittings and making carpentry joints
- Apply engineering skills to do welding, machining, sheet metal and foundry works
- Gain knowledge on Air conditioner, Industrial robot and washing machine
- Understand the domestic, industrial wiring circuits and measure the various electrical parameters
- Analyze the basic components of electronic circuits, computer, laptop, smart phone and LED TV

#### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	3	2	2	-	2	2	-	2	-	-	2
CO3	3	2	1	-	2	2	-	2	-	-	2
CO4	3	2	1	-	2	2	-	2	-	-	2
CO5	3	2	2	-	2	2	-	2	-	-	2

  
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**24GE104L ENGINEERING PRACTICES LABORATORY**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**GROUP A (CIVIL & MECHANICAL)**

**S. No                      Name of Equipment                      Quantity Required**

**CIVIL ENGINEERING PRACTICES**

**Basic Measurements**

1.	Sphere	03 Nos.
2.	Cylinder	03 Nos.
3.	Cone	03 Nos.
4.	Cube	03 Nos.
5.	Cuboid	03 Nos.

**Carpentry**

6.	Industrial truss	03 Nos.
7.	Door Joint	03 Nos.
8.	Window Joint	03 Nos.
9.	Try Square	15 Nos.
10.	Hand Saw	15 Nos.
11.	Carpentry bench vice	15 Nos.
12.	Firmer Chisel	15 Nos.
13.	Motrin Chisel	15 Nos.
14.	Iron Jack	15 Nos.
15.	Mallet	15 Nos.
16.	Bench hold fastens (C Clamp)	15 Nos.
17.	Wood Cutting Machine	2 Nos.
18.	Planer machine	2 Nos.
19.	Hand drilling Machine	2 Nos.
20.	Jig Saw	2 Nos.

**Plumbing**

21.	Pipe Vice	15 Nos.
22.	Die Holder with Die set	10 Nos.

  
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S. No	Name of Equipment	Quantity Required
-------	-------------------	-------------------

**MECHANICAL ENGINEERING PRACTICES**

**Welding**

- |    |                  |        |
|----|------------------|--------|
| 1. | Arc welding unit | 5 Nos. |
| 2. | Gas welding unit | 2 Nos. |

**Basic Machining**

- |    |                   |        |
|----|-------------------|--------|
| 3. | Lathe Machines    | 3 Nos. |
| 4. | Drilling Machines | 2 Nos. |

**Sheet Metal work**

- |     |                   |        |
|-----|-------------------|--------|
| 5.  | Steel rule        | 5Nos.  |
| 6.  | Bend snips        | 5 Nos. |
| 7.  | Straight snips    | 5 Nos. |
| 8.  | Scriber           | 5 Nos. |
| 9.  | Divider           | 5 Nos. |
| 10. | Trammel           | 5 Nos. |
| 11. | Prick Punches     | 5 Nos. |
| 12. | Centre punches    | 5 Nos. |
| 13. | Pliers            | 5 Nos. |
| 14. | Ball peen hammer  | 5 Nos. |
| 15. | Cross peen hammer | 5 Nos. |
| 16. | Bull wart hammer  | 5 Nos. |
| 17. | Mallet            | 5 Nos. |
| 18. | Anvil             | 3 Nos. |
| 19. | Swage block       | 3 Nos. |
| 20. | Wire gauges       | 2 Nos. |

**Foundry work**

- |     |                   |        |
|-----|-------------------|--------|
| 21. | Cope and Drag Box | 5 Nos. |
| 22. | Solid pattern     | 5 Nos. |
| 23. | Split pattern     | 5 Nos. |
| 24. | Runner            | 5 Nos. |
| 25. | Riser             | 5 Nos. |
| 26. | Sprue pin         | 5 Nos. |
| 27. | Sand rammer       | 5 Nos. |
| 28. | Trowel            | 5 Nos. |


**Study Experiments**

- |     |                      |       |
|-----|----------------------|-------|
| 29. | Air-conditioner unit | 1 No. |
| 30. | Industrial Robot     | 1 No. |
| 31. | Washing Machine      | 1 No. |

  
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## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
<b>Part III: Electrical Engineering</b>		
1.	Single phase house wiring setup	5
2.	Three phase house wiring setup	3
3.	Staircase wiring setup	3
4.	Fluorescent lamp and LED with wiring setup	Each 3
5.	Emergency lamp wiring setup	2
6.	Iron box wiring setup	2
7.	Fan with Regulator	2
8.	AC Voltmeter, Ammeter, Wattmeter and Energy Meter	Each 4
9.	R-Load	4
10.	Inductive and Capacitive Load	Each 1
<b>Part IV: Electronics Engineering</b>		
1.	Soldering Iron, Lead	10 Set
2.	Multi meter	10
3.	Continuity tester	10
4.	Used Laptop	3
5.	Used desktop computer	3
6.	Used LED TV	3
7.	Used Smart Phone	3
8.	DC Regulated power supply (0-30V)	2
9.	Resistors	200
10.	Capacitors	200
11.	Diodes	100
12.	Transistors	50

  
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**OBJECTIVES:**

The students should be made to:

- Improve the communicative competence of learners
- Help learners use language effectively in academic/work contexts
- Develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- Build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- Use language efficiently in expressing their opinions via various media.

**UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6**

Listening for general information-specific details - conversation: Introduction to classmates (formal & informal); Telephone conversation; Speaking - Self Introduction-Introducing a friend; - politeness strategies - making polite requests, making polite offers, replying to polite requests and offers - understanding basic instructions (filling out a bank application for example).

**UNIT II NARRATION AND SUMMATION 6**

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events- Talking about current and temporary situations & permanent and regular situations - describing experiences and feelings, engaging in small talk- describing requirements and abilities.

**UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6**

Listening - Listen to product and process descriptions, a classroom lecture; and advertisements about products. Speaking - Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities (large & small)- talking about precautions.


**UNIT IV FUNCTIONAL COMMUNICATION 6**

Listening - Listening to TED Talks; Listening to lectures - and educational videos. Speaking - Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation.

**UNIT V PROFESSIONAL SKILLS 6**

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking -making predictions- talking about a given topic.

**TOTAL: 30 PERIODS**


  
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**OUTCOMES:****On successful completion of the course, the students will be able to,**

- Listen to and comprehend general as well as complex academic information.
- Listen to and understand different points of view in a discussion.
- Speak fluently and accurately in formal and informal communicative contexts.
- Describe products and processes and explain their uses and purposes clearly and accurately.
- Express their opinions effectively in both formal and informal discussions.


**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	3	-	2
CO2	-	-	-	-	-	-	2	2	3	-	2
CO3	-	-	2	-	3	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	3	2	2	3	-	-

  
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**LIST OF EQUIPMENTS**  
**Requirements for a batch of 30 students**

<b>Sl. No.</b>	<b>Description of Equipment/Software</b>	<b>Quantity required (Nos)</b>
1	Computer	30
2	Headphones	30
3	<b>Software:</b> Globarena	30

  
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**OBJECTIVES:****The students should be made to:**

- Improve understanding of commonly used English usage by cultivating listening skills through informal interactions.
- Enrich their speaking abilities through scenario-based conversations to understand how language functions in context.
- Develop their ability to read critically by analyzing newspaper articles.
- Use group discussion techniques to improve cooperative communication.
- Enhance your ability to write professionally by creating organized reports.

**UNIT I CONVERSATION**

9

Listening: Listening to informal conversations, Speaking: Short conversations in varied situations in student life, Reading: Reading Short text and longer passages for comprehension at deeper levels, Writing: Writing reviews (book / film), Grammar: Compound Nouns - Numerical Expression, Vocabulary: Cause and Effect Expressions.

**UNIT II LANGUAGE IN USE**

9

Listening: Listening to Situation based Dialogues, Speaking: Asking about Routine actions and giving directions, Reading: Reading a short story for appreciation and understanding, Writing: Writing Emails - Dialogue writing, Grammar: Purpose expressions - Adverbs, Vocabulary: Imperative sentences.

**UNIT III ENGLISH FOR SPECIFIC PURPOSE**

9

Listening: Listening strategies for deeper understanding, Speaking: Using dictionary for learning pronunciation, stress and syllable divisions, Reading: an article from Newspaper - Critical reading, Writing: Note-Making / Note-Taking - Essay writing, Grammar: Definition, Degrees of Comparison, Vocabulary: Model verbs.

**UNIT IV ENGLISH FOR CAREER**

9

Listening: Listening to the interviews of CEOs / entrepreneur, Speaking: Group Discussion skills, Reading: pre reading and post reading tasks, Writing - Job application - Cover letter & Resume, Grammar: Active and Passive voice, Relative Pronouns, Vocabulary: Synonyms and Antonyms.

**UNIT V REPORT WRITING**

9

Listening: Listening and making notes, Speaking: Discussion on problems and solutions (case studies), Reading: Reading abstracts / Journal Articles, Writing: Minutes of meeting, Reports (Feasibility / Accident / Survey Report), Grammar: If Clause, Vocabulary: Idioms and their Meanings.

**TOTAL: 45 PERIODS**



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**OUTCOMES:**

**On successful completion of the course, the students will be able to,**

- Respond to informal conversations with effectiveness, exhibiting understanding.
- Appreciate and critically engage with short stories, articulating insights.
- Utilize dictionaries to comprehend syllable structures and pronounce words correctly.
- Engage in healthy group discussions by answering peers' questions and sharing ideas.
- Acquire constructive criticism in case study by describing issues.

**TEXT BOOKS:**

1. Bhatnagar, Nitin and Bhatnagar, Mamta, "Communicative English for Engineering and Professionals", Pearson Education India, 2010.

**REFERENCES:**

1. Raman, Meenakshi and Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, Delhi, 2019.
2. Andrea J, Rutherford. "Basic Communication Skills for Technology", Pearson Education, Inc., 2013.
3. Rizvi M, Ashraf. "Effective Technical Communication", Tata McGraw Hill Education Pvt.Ltd., Delhi,2017.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	1	-	-	2	3	-	2
CO2	-	-	1	-	-	2	2	-	3	-	2
CO3	-	-	-	-	2	-	2	-	3	-	-
CO4	-	-	-	2	-	-	2	3	3	-	-
CO5	-	2	-	2	-	2	2	2	3	-	-

  
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**OBJECTIVES:****The Student should be made to:**

- Grasp the fundamental ideas of vectors, vector fields, and scalar fields.
- Identify the field of engineering in ODE as an effective tool for resolving practical issues.
- Interpret the geometric implications of analytic functions in terms of conformal mapping.
- Differentiate the concepts of numerical differentiation and integration procedures, which have significant role in the field of engineering.
- Test the numerous approaches and strategies for resolving different kinds of ODEs.

**UNIT I VECTOR CALCULUS****9+3**

Gradient of a Scalar point function – Divergence, Curl, Solenoidal and irrotational of a vector point function – Directional Derivative – Green's, Gauss divergence and Stoke's theorems (without proof)

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients ( $e^{ax}V, x^nV$ ) – Method of variation of parameters – Cauchy's linear differential equations- Legendre's linear differential equations

**UNIT III ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary condition – Cauchy-Riemann equations and sufficient condition (excluding proofs) Harmonic and orthogonal properties of analytic function – Construction of analytic functions by Milne's method – Conformal mapping ( $w = z + k, 1/z, kz$ ) – Bilinear transformation.


**UNIT IV NUMERICAL DIFFERENTIATION AND INTEGRATION****9+3**

Newton's forward and backward difference formulae – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Single Step methods - Taylor's series method – Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods – Milne's predictor corrector methods for solving first order equations.

**TOTAL: (45+15) PERIODS**

  
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**OUTCOMES:**

On successful completion of the course, the students will be able to,

- Understand the concepts of gradient, divergence, and curl in vector calculus.
- Interpret the suitable techniques for solving second and higher-order differential equations.
- Utilize conformal mapping and analytic functions to transform complex functions between different domains.
- Apply the different approaches and strategies for solving first- and second-order ordinary differential equations.
- Develop the multi-step methods for solving initial value problems.

**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2017.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2018.

**REFERENCES:**

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2018.
2. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7<sup>th</sup> Edition New Delhi, 2013.
3. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pt.Ltd, 4<sup>th</sup> Edition, New Delhi, 2021.
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" 7<sup>th</sup> Edition, Pearson Education India, 2017.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	-	-	-	-	-	2
CO2	3	3	3	3	2	2	-	-	-	-	2
CO3	3	3	3	-	3	-	-	-	-	-	1
CO4	3	3	2	2	2	1	-	-	-	-	2
CO5	3	3	2	3	2	-	-	-	-	-	2

  
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**24MC002      UNIVERSAL HUMAN VALUES 2 - UNDERSTANDING  
HARMONY  
(Common to All Branches)**

**L T P C  
2 1 0 3**

**OBJECTIVES:**

**The students should be made to:**

- Demonstrate an understanding of ethical principles and human values
- Apply critical thinking to analyze ethical dilemmas and conflicts
- Communicate effectively about ethical issues and human values
- Appreciate the importance of harmony in personal, social, and environmental contexts
- Engage in practices that promote ethical behavior and societal harmony

**UNIT 1      INTRODUCTION TO VALUE EDUCATION      6+3**

Value Education – need and process, Self-Exploration – process, Basic Human Aspirations - Continuous Happiness and Prosperity, Basic requirement for fulfilment of Human Aspirants, Understanding Happiness and Prosperity – Continuity of Happiness from Physical Facility.

**UNIT II      HARMONY IN THE HUMAN BEING      6+3**

Human being as a co-existence of the self and the Body - The needs of Self and Body, Body as an Instrument - The Self as the Seer- Doer-Enjoyer, Harmony in the self, Harmony of the Self with the Body –Programme for Self – regulation and health.

**UNIT III      HARMONY IN THE FAMILY AND SOCIETY      6+3**

Family as the basic unit of human interaction , Understanding Relationship, Trust as the foundational value, Respect as the Right Evaluation, Harmony in the society – Understanding Human Goal, Harmony from Family Order to World Family Order – Universal Human Order - Scope.

**UNIT IV      HARMONY IN THE NATURE AND EXISTENCE      6+3**

Nature - as Collections of Units, Classification of Units into Four Orders, Interconnectedness, and mutual fulfilment among the four orders of nature, self-regulation in Nature, Understanding Existence as Units in Space, Existence as Co-existence.

**UNIT V      IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF  
HARMONY ON PROFESSIONAL ETHICS      6+3**

Natural Acceptance of Human Values - Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Constitution, Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production System and Management Models – Typical case, Strategies for Transition towards value based life and profession.

**TOTAL: (30+15) PERIODS**

**OUTCOMES:**

**On successful completion of the course, the students will be able to,**

- Understand the significance of value education and distinguish between values and skills
- Understand the concept of harmony within the self and how it relates to human values
- Analyze the role of family and society in fostering harmony
- Evaluate the relationship between human values and harmony in nature
- Develop skills to resolve conflicts and promote harmony in personal and professional life

  
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**TEXT BOOKS:**

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2<sup>nd</sup> Revised Edition, 2019.

**REFERENCES:**

1. Tripathi A N, "Human Values", New Age Intl. Publishers, New Delhi, 2009.
2. Govindarajan M, Natrajan S and Senthilkumar V S, "Engineering Ethics (Including Human Values)" Eastern Economy, PHI, 12<sup>th</sup> Edition, 2011.
3. Govindarajan M and Natrajan S, "Professional Ethics and Human Values", PHI, 2011.
4. Banerjee B P, "Foundation of Ethics and Management", Excel Publication, 2005.
5. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co, Lucknow, Reprinted 2008.
6. Seebauer and Robert L Berry, "Fundamentals of Ethics for Scientist and Engineers", Oxford University Press, 2000.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	-	-	-	-	-	3	3	-	-	-	3
<b>CO2</b>	-	-	-	-	-	3	3	-	-	-	3
<b>CO3</b>	-	-	-	-	-	3	3	-	2	-	3
<b>CO4</b>	-	-	-	-	-	3	3	-	2	-	3
<b>CO5</b>	-	-	-	-	-	3	3	-	2	-	3



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**OBJECTIVES:****The students should be made to:**

- Understand the structure and function of different ecosystems and concepts of biodiversity.
- Recognize the causes and effects of environmental pollutants and disaster management.
- Explore the natural resources and their sustainability.
- Examine the principles of sustainable development and Green Chemistry.
- Analyze the impacts of population on environment and human health.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9**

Definition, scope and importance of environment - concept of an ecosystem - structure and function of an ecosystem - ecological succession - food chain - food web - structure and function of the (a) forest ecosystem (b) desert ecosystem (c) aquatic ecosystem - (pond and ocean) - Biodiversity: Hot spots of biodiversity - threats to biodiversity - values of biodiversity - endangered and endemic species - conservation of biodiversity: In-situ and ex-situ conservation methods.

**UNIT II ENVIRONMENTAL POLLUTION AND NATURAL CALAMITIES 9**

Definition - causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution (e) Nuclear hazards - solid waste and E-waste Management: role of an individual in prevention of pollution-disaster management: flood, earthquake, cyclone and landslides.

**UNIT III NATURAL RESOURCES 9**

Forest resources: deforestation, mining, dam and their effects on forest and tribal people - Water resources: Use and over - utilization of surface and ground water - dams-benefits and problems - Food resources: World food problems - effects of modern agriculture - fertilizer - pesticide problems, water logging, salinity - Energy resources: renewable energy sources - Solar energy, Tidal energy, Wind energy sources. Land resource: land degradation, Soil erosion and desertification - role of an individual in conservation of natural resources.


**UNIT IV SOCIAL ISSUES AND SUSTAINABILITY 9**

Water conservation - rain water harvesting- resettlement and rehabilitation of people; its problems and concerns - environmental ethics - acid rain, ozone layer depletion - waste land reclamation - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act. Sustainable development-Green Chemistry: Principles of green chemistry - Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transportation.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9**

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - value education - HIV / AIDS - threatening of communicable diseases for human population and its prevention - women and child welfare - role of information technology in environment and human health.

**TOTAL: 45 PERIODS**

  
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BoS (S&H) 19/02/25

**OUTCOMES:**

**On successful completion of the course, the students will be able to,**

- Articulate the significance of ecosystems and biodiversity.
- Evaluate the preventive measures of pollution and calamities.
- Identify the strategies for the conservation of natural resources.
- Retrieve the measures of green chemistry to real-world scenarios.
- Evaluate the issues of overpopulation and communicable diseases on the environment.

**TEXT BOOKS:**


1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, Delhi, 2<sup>nd</sup> Edition, 2018.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 3<sup>rd</sup> Edition, 2016.

**REFERENCES:**

1. G. Tyler Miller, St. Andrews Presbyterian, "Introduction to Environmental Science", Cengage Learning India Pvt., Ltd., 2010.
2. Dharmendra S. Sengar, "Environmental Law", Prentice hall of India Pvt. Ltd, Delhi, 2007.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	3	2	-	-	-	-
CO2	2	2	-	-	-	3	3	-	-	-	-
CO3	-	1	3	-	2	3	-	-	-	-	-
CO4	2	-	3	-	3	-	3	-	-	-	-
CO5	1	2	-	-	-	2	-	-	2	-	-

  
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## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals of computer and programming.
- Choose appropriate data types, variables and statements for solving simple problems.
- Construct programs using arrays and pointers for a given scenario.
- Build programs using strings and functions in C language.
- Develop programs using structure, union and files for a given scenario.

## TEXT BOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Pearson India Education Services Pvt. Ltd., 2016.

## REFERENCES:

1. Ajay Mital, "Programming in C - A Practical Approach", Pearson Education, 2015.
2. Dromey R G, "How to Solve it by Computer", Pearson Education, Fifteenth Impression, 2014.
3. Herbert Schildt, "C - The Complete Reference", Tata McGraw-Hill, 2013.
4. Ashok N Kamthane, "Computer Programming", Pearson Education, Second Edition, 2012.
5. Juneja B L and Anita Seth, "Programming in C", Cengage Learning India Pvt. Ltd., 2011.

## Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	2	2	-
CO3	3	2	2	2	-	-	-	-	2	2	1
CO4	3	2	2	2	2	-	-	-	2	2	1
CO5	3	2	2	2	2	-	-	-	2	2	1



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**OBJECTIVES:**

The students should be made to:

- Solve AC and DC circuit using network reduction technique
- Impart knowledge on solving circuit using network theorems
- Know the concept of resonance and coupled circuits
- Understand the transient response of various AC and DC circuits
- Acquire knowledge on polyphase circuits and techniques for measuring power

**UNIT I BASIC CIRCUITS ANALYSIS****9+3**

Electrical quantities – Network elements – R, L and C parameters – Energy sources – Ohm's law – Kirchhoff's laws – Power in series circuits – Resistors in series and parallel – Mesh and Nodal analysis for AC and DC circuits – Dependent sources – Fundamentals of AC circuits.

**UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS****9+3**

Network reduction: Voltage and current division, Source transformation – Star delta conversion. Thevenin's and Norton's theorem – Superposition theorem – Maximum power transfer theorem – Millman's theorem – Tellegen's theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS****9+3**

Resonance: Series and parallel resonance – Resonant frequency of tank circuit – Quality factor and Bandwidth. Coupled circuits: Self and mutual inductance – Coefficient of coupling. Tuned circuits: Single tuned circuits. Analysis of magnetic circuits – Composite series and parallel magnetic circuits.

**UNIT IV TRANSIENT RESPONSE ANALYSIS****9+3**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and AC sinusoidal input – Introduction to Laplace transform for step, impulse and periodic functions.

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30/03/2026

## UNIT V POLYPHASE CIRCUITS

9+3

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – Phasor diagram of voltages and currents – Power and power factor measurement in the three phase circuits.

**TOTAL: 45+15 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Understand the fundamentals of electric circuit
- Apply various theorems for analyzing AC and DC circuits
- Acquire knowledge about resonant, tuned, and coupled circuits
- Analyze the transient behavior of electrical circuits
- Summarize the operation of polyphase circuits and power measurements

### TEXT BOOK:

1. Sudhakar A and Shyam Mohan S P, “Circuits and Networks: Analysis and Synthesis”, Fifth Edition, McGraw Hill, 2017.


### REFERENCES:

1. Chakrabarti A, “Circuit Theory (Analysis and Synthesis)”, Revised Edition, Dhanpath Rai and Co., 2023.
2. Salivahanan S, “Circuit Theory Analysis and Synthesis”, First Edition, Pearson Education, 2021.
3. Charles K Alexander, Matthew N O Sadiku, “Fundamentals of Electric Circuits”, McGraw-Hill Education, Sixth Edition, 2019.
4. William H Hayt, Jack Kemmerly, Steven Durbin M, “Engineering Circuit Analysis”, McGraw Hill Publications, Eighth Edition, 2013.
5. Robins and Miller, “Circuit Analysis: Theory and Practice”, Delmar Publishers, Fifth Edition, 2012.

  
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**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	2	3	3

  
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**OBJECTIVES:****Students should be made to:**

- Gain knowledge about weaving and ceramic Technology
- Creating a design and construction Technology
- Analyzing manufacturing Technology
- Applying agriculture and irrigation Technology
- Remembering scientific and scientific Tamil and Tamil computing

**UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo -Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY 3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing Knowledge of Sea - Fisheries– Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS****OUTCOMES:**

**On successful completion of the course, the students will be able to,**

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.



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### TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை- (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) -- Reference Book.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	2	1	-	-	1
CO2	-	-	-	-	-	-	2	1	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	1
CO4	-	-	-	-	-	-	2	1	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	1

  
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**நோக்கம்:****மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன:**

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில் நுட்பத்தை பகுப்பாய்வு செய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில் நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல் மற்றும் அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை நினைவில் கொள்ளுதல்.

**அலகு 1 நெசவு மற்றும் பாளை தொழில் நுட்பம் 3**  
சங்க காலத்தில் நெசவுத்தொழில் - பாளை தொழில் நுட்பம் - கருப்பு, சிவப்பு பாண்டங்கள் - பாண்டுகளில் கீறல் குறியீடுகள்.

**அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3**  
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் நாயக்கர் கால கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.

**அலகு 3 உற்பத்தித் தொழில்நுட்பம் 3**  
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடிகள் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்பு துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம் 3**  
அணை, குளங்கள், மதகு - சோழர்கால குமுளி தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்து குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

  
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## அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்

3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

### முடிவுகள்:

#### பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- பீங்கான் மற்றும் நெசவு தொழில்நுட்பத்தைப் புரிந்து கொள்ளுதல்.
- புதிய வடிவமைப்பு மற்றும் கட்டுமான தொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தித் தொழில் நுட்பத்தை அடையாளம் காணுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத்தைப் புரிந்து கொள்ளுதல்.
- அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை பெறுதல்.

### உரை மற்றும் குறிப்பு புத்தகங்கள்:


1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை- (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
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11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

  
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**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	-	-	-	-	-	-	2	1	-	-	1
<b>CO2</b>	-	-	-	-	-	-	2	1	-	-	1
<b>CO3</b>	-	-	-	-	-	-	2	1	-	-	1
<b>CO4</b>	-	-	-	-	-	-	2	1	-	-	1
<b>CO5</b>	-	-	-	-	-	-	2	1	-	-	1

  
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**OBJECTIVES:**

**The Student should be made to:**

- Learn how to develop C programs using conditional and looping statements
- Understand the concept of functions, arrays and strings
- Learn how to access memory using pointers
- Group different kinds of data related to a single entity
- Understand the manipulation of data in permanent storage

**LIST OF EXPERIMENTS:**

1. Programs using decision making statements.
2. Programs using looping statements.
3. Programs using user defined functions and recursive functions.
4. Programs using one dimensional and two dimensional arrays.
5. Solving problems using string functions.
6. Programs using pointers and dynamic memory allocation.
7. Programs using structures and unions.
8. Programs using pointers to structures and other data types.
9. Programs using text files.
10. Programs using binary files.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Implement C programs using control statements.
- Write C programs using functions, arrays and strings.
- Write C programs to access data in memory using pointers.
- Develop C programs using structures and other user defined data structures to manipulate heterogeneous data.
- Build C programs to manipulate data stored on permanent storage.

**List of Equipment for a Batch of 30 Students:**

- Standalone desktops with C compiler or Server with C compiler for 30 Nos.

**Mapping of COs with POs :**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	-	-	-	2	3	-	-
CO2	3	2	3	2	-	-	-	2	3	-	-
CO3	3	2	3	2	-	-	-	2	3	-	2
CO4	3	2	3	2	2	-	-	2	3	-	2
CO5	3	2	3	2	2	-	-	2	3	-	2

*N. Prabhakar*

CHAIRMAN  
BoS (IT)

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**COURSE OBJECTIVES:**

**The students should be able to:**

- Simulate the electric circuit problems
- Solve the electric circuits using various theorems
- Impart knowledge on transient response of electric circuits
- Understand the concept of resonance circuits
- Learn about various three-phase connections

**LIST OF EXPERIMENTS:**

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage law.
2. Simulation and experimental verification of electrical circuit problems using Kirchhoff's current law.
3. Simulation and experimental verification of electrical circuit problems using Mesh analysis.
4. Simulation and experimental verification of electrical circuit problems using Nodal analysis.
5. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
6. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
7. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
8. Simulation and experimental verification of Maximum Power transfer theorem.
9. Simulation and experimental validation of RC transients.
10. Simulation and experimental validation of RLC transients.
11. Design and implementation of series resonance circuits.
12. Simulation of three phase balanced star and delta circuits.

**TOTAL: 45 PERIODS**

  
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## COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the fundamental circuit law for DC circuits
- Analyze the circuit problems by using various theorems
- Acquire knowledge of the transient behavior of electric circuits
- Design the resonance circuits
- Interpret various three-phase connections

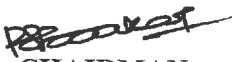
## Mapping of COs with POs, PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	2	-	-	2	3	3
CO2	3	3	2	2	2	-	-	2	-	-	2	3	3
CO3	3	3	2	2	2	-	-	2	-	-	2	3	3
CO4	3	3	2	2	2	-	-	2	-	-	2	3	3
CO5	3	3	2	2	2	-	-	2	-	-	2	3	3

  
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## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	Personal computers with e-Sim/Scilab/Pspice / MATLAB /other Equivalent software Package	10
2.	Printer	1
3.	Regulated power supply (0 - 30)V	10
4.	Function Generator (3 MHz)	10
5.	Cathode Ray Oscilloscope (30 MHz)	10
6.	Digital Storage Oscilloscope (50 MHz)	1
7.	DC – Voltmeter (0 – 30)V	10
8.	DC – Ammeter (0 – 100)mA	15
9.	Multimeter	10
10.	Decade resistance, inductance and capacitance box	Each 6
11.	Bread boards	10
12.	Resistors and Capacitors of various ranges	As required
13.	Connecting Wires	As required

  
 CHAIRMAN  
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**OBJECTIVES:****The students should be made to:**

- Establish effective time management techniques and professional grooming routines.
- Make progress on their own presentations by utilizing visual aids and interacting with the audience.
- Obtain the ability to participate in group conversations effectively and comprehend group dynamics.
- Recognize the protocol required for different types of interviews.
- Develop strategies for stress management, time management, and professional networking.

**UNIT I SOFT SKILLS DEVELOPMENT 6**  
Introduction to Soft Skills - Hard skills & soft skills - Employability and Career Skills - Grooming as a professional with values - Time Management - General awareness of Current Affairs.

**UNIT II DEVELOPING SELF ESTEEM 6**  
Self-Introduction-organizing the material - Introducing oneself to the audience - introducing the topic - answering questions - individual presentation practice - presenting the visuals effectively - Five minutes presentation

**UNIT III PROFESSIONAL SKILLS 6**  
Introduction to Group Discussion - Participating in group discussions - understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies - activities to improve GD skills

**UNIT IV COMMUNICATION ETIQUETTES 6**  
Interview etiquette - dress code - body language - attending job interviews - telephonic interview - one to one interview & panel interview - FAQs related to job interviews

**UNIT V MANAGEMENT SKILLS 6**  
Recognizing the differences between groups and teams - managing time - managing stress-networking professionally- respecting social protocols - understanding career management-developing a long- term career plan-making career changes.

**TOTAL: 30 PERIODS****OUTCOMES:****On successful completion of the course, the students will be able to,**

- Develop employability skills such as communication, teamwork, adaptability, and problem-solving.
- Enhance confidence and competence in answering questions effectively during presentations and discussions.
- Apply group discussion techniques and real-world exercises to improve debating abilities.
- Prepare for various job interviews, including panel, one-on-one, and telephone interviews.
- Formulate a comprehensive career plan, focusing on networking and career progression.

  
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BoS (S&H) 19/02/25


**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	-	-	-	-	-	-	-	3	3	-	3
<b>CO2</b>	-	-	-	-	-	-	-	3	2	-	3
<b>CO3</b>	-	-	-	-	-	-	-	2	3	-	3
<b>CO4</b>	-	-	-	-	-	-	-	3	3	-	3
<b>CO5</b>	-	-	-	-	-	-	-	3	2	-	2

  
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BoS (S&H) 19/02/25

**LIST OF EQUIPMENTS**  
**Requirements for a batch of 30 students**

<b>Sl. No.</b>	<b>Description of Equipment/Software</b>	<b>Quantity required (Nos)</b>
1	Computer	30
2	Headphones	30
3	<b>Software:</b> Globarena	30

  
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BoS (S&H) 19/02/25



**TEXT BOOKS:**

1. Veerarajan T., "Transforms and Partial Differential Equations", 3<sup>rd</sup> Edition, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
2. Grewal B.S., "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, Delhi, 2017.

**REFERENCES:**

1. Bali N.P and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd., 9<sup>th</sup> Edition, 2016.
2. Ramana B V, "Higher Engineering Mathematics", New Delhi Tata McGraw- Hill Education India Private Limited., 2018.
3. Glyn James, "Advanced Modern Engineering Mathematics", 4<sup>th</sup> Edition, Pearson Education, 2011.
4. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2011.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	-	2	-	2	-	-	2
CO2	3	2	2	-	-	2	-	2	-	-	2
CO3	3	3	3	2	-	2	-	2	-	-	2
CO4	3	2	2	-	-	1	-	2	-	-	2
CO5	3	2	3	2	-	1	-	2	-	-	2

  
CHAIRMAN  
BoS (S&H) 14/10

**OBJECTIVES:****The students should be made to:**

- Recall the fundamental mathematical concepts related to vector algebra and coordinate systems
- Understand the basic concepts of static electric fields and their significance in electromagnetism
- Interpret the behavior of conductors, dielectrics and their applications
- Learn the essential laws governing static magnetic fields and their applications
- Examine the principles of time-varying fields and formulate Maxwell's equations

**UNIT I      ELEMENTS OF VECTOR CALCULUS      9**

Sources and effects of electromagnetic fields – Scalar and Vector Fields – Review of vector algebra. Different co-ordinate systems – Rectangular, Cylindrical, Spherical co-ordinate systems – Conversion of co-ordinate system. Gradient, Divergence and Curl – Divergence Theorem – Stoke's Theorem.

**UNIT II      STATIC ELECTRIC FIELD      9**

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and applications – Electric potential – Electric Dipole and flux lines – Energy density – Application: Electrostatic discharge and CRT.

**UNIT III      CONDUCTORS, DIELECTRICS AND CAPACITANCE      9**

Electric field in free space, conductors – Dielectric polarization – Dielectric constant and Dielectric strength – Electric field in multiple dielectrics – Boundary conditions: Conductor – Dielectric, Conductor – Free space and Dielectric–Dielectric – Poisson's and Laplace's equations – Capacitance.

**UNIT IV      STATIC MAGNETIC FIELDS      9**

Biot-Savart Law – Ampere's Law – Magnetic field due to straight conductors, circular loop, infinite sheet of current – Magnetic flux density (B) – Magnetization – Boundary conditions – Scalar and vector potential – Energy density – Applications.

**UNIT V      TIME VARYING FIELDS AND MAXWELL'S EQUATIONS      9**

Faraday's laws – Transformer and motional EMF – Maxwell's equations (differential and integral forms) – Displacement current and conduction current. Derivation of generalized Wave Equations from Maxwell's equations – Poynting vector and theorem.

**TOTAL: 45 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand various parameters in vector algebra and coordinate systems
- Apply the basic concepts of electrostatic fields to determine electric field intensity, electric potential, and energy density
- Describe the properties and behavior of electric fields in conductors and dielectrics
- Compute magnetic field intensity using fundamental laws of magnetism
- Formulate Maxwell's equations and the corresponding wave equations

*P. P. Prasad*  
CHAIRMAN  
BoS (EEE) 16/10

**TEXT BOOK:**

1. Matthew N O Sadiku, and Kulkarani S V, “Principles of Electromagnetics”, Oxford University Press, Sixth Edition, 2015.

**REFERENCES:**

1. William H Hayt and John A Buck, “Engineering Electromagnetics”, Tata McGraw Hill, New Delhi, Ninth Edition, 2020.
2. Jordan E C and Balmain K G, “Electromagnetic Waves and Radiating Systems” Pearson Education/PHI, Second Edition, 2015.
3. Gangadhar K A and Ramanathan P M, “Electromagnetic Field Theory (Including Antennas and Wave Propagation)”, Khanna Publishers, Eighth Edition, 2015.
4. Kraus Fleisch, “Electromagnetics with Applications”, McGraw Hill International, Fifth Edition, 2017.
5. Sarwate V V, “Electromagnetic Fields and Waves”, New age Publishers, Second Edition, 2018.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	2
CO3	3	3	2	2	–	–	–	–	–	–	2	3	2
CO4	3	3	2	2	–	–	–	–	–	–	2	3	2
CO5	3	3	2	2	–	–	–	–	–	–	2	3	2

  
CHAIRMAN  
BoS (EEE)

**OBJECTIVES:****The Student should be made to:**

- Understand the Digital fundamentals, Boolean algebra, digital logic and simplification
- Study the circuit minimization techniques and its applications in digital systems
- understand the concepts of combinational logic circuits using logic gates
- Analyze the design procedures for synchronous sequential circuits with flipflop elements.
- Learn various semiconductor memories and related technology

**UNIT I NUMBER SYSTEM AND BOOLEAN ALGEBRA 9**

Digital Systems- Binary Numbers-Number-Base Conversions- Octal and Hexadecimal Number-Complement- Signed Binary Numbers- Binary Code-Binary Storage and Registers-Binary Logic- Definition of Boolean Algebra- Basic Theorems and Properties of Boolean Algebra- Boolean Functions - Canonical and Standard Forms- Other Logic Operations- Digital Logic Gates- Integrated Circuit.

**UNIT II MINIMIZATION TECHNIQUES 9**

The Map Method - Four-Variable Map- five variable Map-product-of-Sums Simplification- Don't-Care Conditions- NAND and NOR implementation- Other Two-level Implementation of exclusive OR Function- Hardware Description Language.

**UNIT III COMBINATIONAL CIRCUITS 9**

Introduction- Combinational Circuit- Analysis Procedure- Design Procedures- Binary Adder -Subtractor Decimal Adder - Binary Multiplier -Magnitude Comparator – Decoder- Encoders- Multiplexer- HDL Models of Combinational Circuits.


**UNIT IV SEQUENTIAL CIRCUITS 9**

Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, Latches, Flip-Flops, SR,JK,D,T and Master slave, Characteristic Tables and Equations, Conversion from one type of Flip-Flop to another, Counters - Design of Mode Counter, Ripple Counter, Ring Counter, Shift Register, Ring counter using Shift Register

**UNIT V MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES 9**

Classification of memories – ROM : ROM organization, PROM, EPROM,EEPROM, RAM: RAM organization, Write operation, Read operation, Static RAM , Programmable Logic Devices: Programmable Logic Array(PLA),Programmable Array Logic, Implementation of Combinational Logic circuits using PROM,PLA,PAL.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (ECE) 16/07/25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Discuss the significance of number systems, conversions, binary codes
- Apply different simplification methods for minimizing Boolean functions.
- Analyze the design concepts of various combinational circuits
- Analyze the concepts of sequential logic design
- Understand SRAM/DRAM organization and periphery circuitry, operation of SRAM cell, DRAM

**TEXT BOOKS:**

1. Morris Mano.M and Michael D. Ciletti,"Digital Design", 6th Edition, Pearson, 2019.

**REFERENCES :**

1. Charles H.Roth,"Fundamentals of Logic Design", 6<sup>th</sup> Edition, Thomson Learning, 2021.
2. Thomas L. Floyd," Digital Fundamentals", 10<sup>th</sup> Edition, Pearson Education Inc, 2011
3. Salivahanan.S and Arivazhagan.S,"Digital Electronics", 1<sup>st</sup> Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini," Digital Electronics: Principles, Devices and Applications " , John Wiley & Sons, Ltd, 2014.
5. A.Anand Kumar, "Fundamentals of Digital Circuits", 4<sup>th</sup> Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal,"Digital Electronics", McGraw Hill Education Private Limited, 2016.

**MAPPING OF COs WITH POs AND PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	2	2	1
CO2	3	2	2	1	2	-	-	-	-	-	2	2	1
CO3	3	2	2	2	1	1	-	-	-	-	2	2	1
CO4	3	2	2	2	-	2	-	-	-	-	2	2	1
CO5	3	3	2	2	-	2	-	-	-	-	2	2	1

  
CHAIRMAN  
BoS (ECE)

**OBJECTIVES:****The students should be made to:**

- Comprehend the operation and characteristics of diodes, rectifiers
- Understand the knowledge on transistor operation and its biasing circuits
- Familiarize the operation of field effect controlled devices
- Learn about feedback amplifiers and oscillators
- Acquire the knowledge on power amplifiers and special devices

**UNIT I PN JUNCTION DIODE AND RECTIFIERS 9**  
 PN junction diode – Operation, VI characteristics – Zener diode – VI characteristics, Zener diode as a Voltage Regulator.

**Rectifiers:** Half wave and full wave rectifiers, Average and RMS value, Ripple factor, Regulation and Rectification efficiency – C, RC and LC filters.

**UNIT II BJT AND ITS BIASING 9**  
 Transistor construction, operation – Input and output characteristics – CE, CB and CC configurations – Hybrid model – Transistor switching.

**Biasing:** Operating point, load line and stability factor and voltage divider bias – BJT as an amplifier – CE amplifier small signal analysis.

**UNIT III FIELD CONTROLLED DEVICES 9**  
 JFET: Construction, operation and characteristics, parameters, pinch-off voltage – MOSFET: Construction, operation and characteristics – Enhancement and depletion types – Parameters – MOSFET small signal model. UJT: Characteristics, operation and saw tooth oscillators.

**UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9**  
 Advantages of negative feedback – Voltage / Current, Series, Shunt feedback Amplifiers – positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

**UNIT V POWER AMPLIFIERS AND SPECIAL DEVICES 9**  
 Power amplifiers: Class A, B, C, D and AB. Structure, Symbol, Working and Characteristics of Schottky diode, Varactor diode and Tunnel diodes. Optocouplers: Photo diode, Photo transistor – LED and LCD.

**TOTAL: 45 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand the operation of diodes and rectifiers
- Investigate the characteristics of BJT and its biasing techniques
- Describe the characteristics of field effect transistors
- Explore the principles and applications of amplifiers and oscillators
- Analyze the operation of power amplifiers and special devices

*R. S. Rao*  
 CHAIRMAN  
 BoS (EEE) 15/10

**TEXT BOOK:**


1. Robert L Boylestad, Louis Nashelsky “Electronic Devices and Circuit Theory”, Prentice Hall of India, Eleventh Edition, 2015.

**REFERENCES:**

1. David A Bell, “Electronic Devices and Circuits”, Prentice Hall India, Fifth Edition, 2008.
2. Albert Paul Malvino, “Electronic Principles”, McGraw Hill, Seventh Edition, 2017.
3. Millman and Halkias, “Electron Devices and Circuits”, McGraw Hill, New Delhi, Fourth Edition, 2015.
4. Anil K Maini and Varsha Agarwal, “Electronic Devices and Circuits”, John Wiley United States, Reprint, 2012.
5. Sedha R.S, “A Text Book of Electronic Devices and Circuits”, S. Chand and Company Ltd., Reprint, 2017.
6. Mithal G K, “Electronic Devices and Circuits”, Khanna Publishers, Ninth Reprint, 2017.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	1	-	-	-	-	-	-	-	2	3	2
<b>CO2</b>	3	3	1	-	-	-	-	-	-	-	2	3	2
<b>CO3</b>	3	3	1	-	-	-	-	-	-	-	2	3	2
<b>CO4</b>	3	3	2	-	-	-	-	-	-	-	2	3	2
<b>CO5</b>	3	3	2	-	-	-	-	-	-	-	2	3	2

  
CHAIRMAN  
BoS (EEE)

**OBJECTIVES:**

The students should be made to:

- Learn the fundamental principles of magnetic circuits and electromechanical energy conversion systems
- Describe the various types and characteristics of DC generators and compare their functionalities
- Analyze the various types of DC motors, focusing on their starting methods and testing procedures
- Apply the appropriate testing procedures to evaluate transformer performance
- Outline the operation of autotransformers and three phase transformers

<b>UNIT I</b>	<b>ELECTROMECHANICAL ENERGY CONVERSION</b>	<b>9</b>
Fundamentals of magnetic circuits – Magnetically induced EMF and forces – Principle of electromechanical energy conversion forces and torque in magnetic field systems – Energy in magnetic system – Field energy and mechanical force – Single and Multiple excited magnetic systems – Forces in systems with permanent magnet – MMF of distributed AC windings – Rotating magnetic field – Torque in round rotor machine – Introduction to Indian Standard Specifications (ISS).		
<b>UNIT II</b>	<b>DC GENERATORS</b>	<b>9</b>
Principle of operation – Constructional details – Types – Armature windings and commutator – EMF equation – Armature reaction – Compensating winding – Commutation – Methods of excitation – Losses and Efficiency – Operating characteristics of DC generators – Characteristics of DC generators – Parallel operation of DC generators – Applications of DC generators.		
<b>UNIT III</b>	<b>DC MOTORS</b>	<b>9</b>
Principle of operation – Types – Torque equations and power developed by armature – Characteristics of DC motor – Starting of DC motors – Speed control of DC motors – Braking of DC motors – Losses and Efficiency – Testing of DC machines – Applications of DC motors.		
<b>UNIT IV</b>	<b>SINGLE PHASE TRANSFORMERS</b>	<b>9</b>
Construction and practical considerations – Transformer on No-Load – Transformer On Load – Equivalent circuit – Transformer losses – Transformer testing – Efficiency and Voltage regulation – Excitation phenomenon in transformers.		
<b>UNIT V</b>	<b>AUTOTRANSFORMER AND THREE PHASE TRANSFORMER</b>	<b>9</b>
Construction and working of auto transformer – Saving of copper in auto transformer – Applications of autotransformer. Three Phase Transformers: Construction – Three phase transformer connections – Parallel operation of transformers – Three winding transformer – Scott connection.		

**TOTAL: 45 PERIODS**

*Prabakar*  
CHAIRMAN  
BoS (EEE) 15/11/16

**OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand the working principles of electrical machines using the concepts of electromechanical energy conversion
- Illustrate the performance variations of DC generators under different load conditions
- Describe the working, types, starting and testing methods of DC motors
- Examine the results from transformer tests to assess their performance characteristics
- Analyze the performance of three-phase transformers and autotransformers

**TEXT BOOK:**

1. Nagrath J and Kothari D P, "Electric Machines", McGraw Hill Education, Fifth Edition, 2017.

**REFERENCES:**

1. Bimbhra P S, "Electric Machinery", Khanna Publishers, Second Edition, 2021.
2. Fitzgerald A E and Kingsley C, "Electric Machinery", New York, McGraw Hill Education, Sixth Edition, 2017.
3. Gupta B R, "Fundamentals of Electric Machines" New age International Publishers, Fourth Edition, Reprint, 2023.
4. Clayton A E and Hancock N N, "Performance and Design of Direct Current Machines", CBS Publishers, 2018.
5. Stephen J Chapman, "Electric Machinery Fundamentals", McGraw Hill Education Private Limited, Fourth Edition, 2010.
6. Theraja B L, Theraja A K, "A Textbook of Electrical Technology", Volume II, S Chand limited, Twenty Third Edition, 2023.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	–	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	–	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	2	–	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	2	–	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	2	–	–	–	–	–	–	–	2	3	2

*P&P*  
 CHAIRMAN  
 BoS (EEE)

<b>24CS302</b>	<b>OBJECT ORIENTED PROGRAMMING USING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>JAVA</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>
	<b>(Common to AD, CSE, EEE &amp; IT)</b>				

**OBJECTIVES:****The Student should be made to:**

- Understand the basic concepts of oops and java
- Illustrate the concepts of overloading and inheritance.
- Know the principles of packages, interfaces and exceptions.
- Teach the concepts of networking and i/o systems
- Develop an interactive applications using event driven programming

**UNIT I OOPS AND JAVA FUNDAMENTALS 9**

Programming Language types and paradigms - Object Oriented Programming Concepts- History of Java - Java buzzwords- Data Types –variables – Operators - Control Statements in Java- Type Conversion and Casting-Array. Introducing Classes: Class Fundamentals – Declaring Objects – Methods –Constructors – Garbage Collection – this keyword.

**UNIT II METHOD OVERLOADING AND INHERITANCE 9**

Method overloading -Object as parameters – Returning Objects – Recursion – Access Control – Static– Final- Constructor Overloading.

Inheritance Basis – Using super- Types: Single – Multilevel - Hierarchical - The Cosmic Superclass – Method Overriding - Abstract Class - Final with Inheritance.

**UNIT III PACKAGES, INTERFACES AND EXCEPTION HANDLING 9**

Packages – Importing packages- Interfaces – Static, Default and Private Methods. Exception- Handling Fundamentals-Exception Types – Uncaught Exceptions – Using Try and Catch– Built-in Exceptions - User defined exceptions. String: String Methods and Operations

**UNIT IV MULTITHREAD PROGRAMMING AND INPUT / OUTPUT STREAMS 9**

Multithreaded Programming – Thread Model – Thread Creation – Life Cycle – Thread Priorities - Synchronization of Threads – Inter thread Communication – Suspending, Resuming and Stopping Threads.

I/O Basics – Streams – Byte streams and Character streams – Reading and Writing Console – The PrintWriter Class- Reading and Writing Files –Scanner Class.

  
CHAIRMAN  
BoS (CSE)

1/2/25



**TEXT BOOKS:**

1. Herbert Schildt, "Java - The complete reference", 13<sup>th</sup> Edition, Tata Mc Graw Hill, 2024.

**REFERENCES:**

1. Cay S. Horstmann, "Core Java SE 9 for the Impatient", 2<sup>nd</sup> Edition, Addison-Wesley, 2017.
2. Paul Deitel, Harvey M. Deitel, "Java How to Program", 11<sup>th</sup> Edition, Pearson Education, 2018.
3. Balagurusamy E, "Programming in Java" McGraw Hill Education. 6<sup>th</sup> Edition. 2019.
4. Steven Holzner, "Java 2 Black Book", Dreamtech Press. 2011.

**COs – POs Mapping**

COURSE OUTCOMES	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	2	3	2	2	-	-	2	-	-	3	2	2
2	3	3	3	2	2	-	-	2	-	-	2	2	2
3	3	2	2	2	2	-	-	2	-	-	2	2	2
4	3	2	3	2	2	-	-	2	-	-	2	2	2
5	3	2	3	2	3	2	2	3	2	2	2	2	2
Average	3	2.2	2.6	2	2.2	2	2	2.2	2	2	2.2	2	2

*C. Saravanan*  
 CHAIRMAN  
 BoS (CSE)

1/2/25

**OBJECTIVES:**

**The students should be able to:**

- Learn the functional behavior of semiconductor and optocoupler devices
- Compare the characteristics of different types of transistors
- Investigate the characteristics of amplifiers and filters
- Conduct simulations and testing of electronic circuits
- Design and simulate the various types of oscillators

**LIST OF EXPERIMENTS:**


1. Characteristics of PN junction diode and Zener diode.
2. Characteristics of photo diode and photo transistor.
3. Characteristics of a NPN Transistor under common emitter, common collector and common base configurations.
4. Characteristics of JFET and draw the equivalent circuit.
5. Characteristics of UJT and generation of saw tooth waveforms.
6. Differential amplifiers using FET.
7. Realization passive low pass filter and high pass filter.
8. Simulation of Single Phase half wave rectifier.
9. Simulation of Single Phase full wave rectifier.
10. Simulation of LC oscillator.
11. Design and testing of RC phase shift oscillator.
12. Design and testing of Wien bridge oscillator.

**TOTAL: 45 PERIODS**

**OUTCOMES:**


**On successful completion of this course, the students will be able to,**

- Understand the characteristics of semiconductor and optocoupler devices
- Demonstrate the operating characteristics of different transistors
- Design the differential amplifier and filter circuits
- Simulate the electronic circuits using software tools
- Analyze the performance of different types of oscillators

  
CHAIRMAN  
BoS (EEE) 15/10


**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	1	2	-	-	1	2	-	-	2	3	2
<b>CO2</b>	3	3	2	2	-	-	1	2	-	-	2	3	2
<b>CO3</b>	3	2	2	2	-	-	1	2	-	-	2	3	2
<b>CO4</b>	3	2	2	2	3	-	1	2	-	-	2	3	2
<b>CO5</b>	3	2	2	2	3	-	1	2	-	-	2	3	2

  
CHAIRMAN  
BoS (EEE)

## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	Personal Computer with Simulation software tool (OrCAD PSpice or any other equivalent software)	5
2.	Regulated Power Supply	10
3.	Cathode Ray Oscilloscope	10
4.	Digital Storage Oscilloscope	1
5.	Function Generators	10
6.	Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box	Each 6
7.	Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor	Each 10
8.	Resistors and Capacitors of various ranges	As required
9.	Necessary digital IC	Each 10
10.	Bread boards	10

  
**CHAIRMAN**  
 BoS (EEE) 06/05/25

**OBJECTIVES:**

The students should be able to:

- Know the performance of DC generators for different load conditions
- Understand the load characteristics of DC motors
- Illustrate the performance of DC machine
- Perform appropriate tests on transformers to assess their efficiency
- Outline the steps to conduct performance test on a single-phase transformer

**LIST OF EXPERIMENTS:**

1. Open circuit and load characteristics of separately and self excited DC shunt generators.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load characteristics of DC shunt and DC series motor.
4. Swinburne's Test and Speed control of DC shunt motor.
5. Hopkinson's test on DC motor – Generator set.
6. Load test on single phase transformer.
7. Load test on three phase transformer.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on single phase transformers.
10. Separation of no load losses in single phase transformer.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the performance characteristics of various DC generators
- Conduct load test on DC motors to obtain their performance characteristics
- Perform test to measure various losses in DC machines under various load conditions
- Calculate the efficiency of a transformer by conducting load test
- Examine the test results of a transformer to assess its performance

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	3	2	-	-	1	2	-	-	2	3	2
<b>CO2</b>	3	3	3	2	-	-	1	2	-	-	2	3	2
<b>CO3</b>	3	3	3	2	-	-	1	2	-	-	2	3	2
<b>CO4</b>	3	3	3	2	-	-	1	2	-	-	2	3	2
<b>CO5</b>	3	3	3	2	-	-	1	2	-	-	2	3	2

*P.P. Perera*  
CHAIRMAN  
BoS (EEE) 15/10

## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	DC Shunt Motor (5HP, 220V, 1500RPM) Coupled with DC Shunt Generator (3.5 kW, 220V, 1500 RPM) with Starter	2
2.	DC Shunt Motor (5HP, 220V, 1500RPM) Coupled with DC Compound Generator (3.5 kW, 220V, 1500RPM) with Starter	2
3.	DC Shunt Motor (5HP, 220V, 1500RPM) with Loading arrangement with 3 Point Starter.	3
4.	DC Series Motor (5HP, 220V, 1500RPM) with Loading arrangement with 2 Point Starter.	1
5.	DC Compound Motor (5HP, 220V, 1500RPM) with Loading arrangement with 4 Point Starter.	1
6.	Single Phase Transformer	12
7.	Three Phase Transformer	3
8.	Single Phase Resistive Load	7
9.	Three Phase Resistive Load	3
10.	Three Phase Autotransformer	4
11.	Single Phase Autotransformer	9
12.	Tachometers Digital/Analog	10
13.	Rheostat of various ranges	As required
14.	MI/MC Voltmeter	As required
15.	MI/MC Ammeter	As required
16.	UPF/LPF Wattmeter	As required

*P. Prasad*  
**CHAIRMAN**  
 BoS (EEE) 06/05/25

**OBJECTIVES:****The students should be made to:**

- Enhance the development of students by focusing on soft skills
- Develop skills of the students through individual and group activities
- Shape students' attitude and behaviour through activities
- Analyze the characteristics of the students for self-development
- Prepare themselves for the recruitment processes

**UNIT I SOFT SKILLS ARE IMPORTANT FOR SUCCESS** 6  
Importance of Soft Skills - Types - Industrial needs - Development of skills – Employees' expectation - Success of employees.

**UNIT II CORPORATE COMMUNICATION** 6  
Needs and Development of Communication - Customers Relationship - Improving informal communication - Formation of presentations - Public Speaking - Telephone and Email Etiquettes.


**UNIT III DISCUSSIONS** 6  
Introduction to Discussion - Importance and types of discussion - Spontaneous conversation - Plan for discussions - Panel discussions - Visual Aid discussions - Debate.

**UNIT IV SELF ANALYSIS** 6  
Who am I - Identifying or searching one's own Strength, Weakness - Opportunities and Threats (SWOT Analysis) - Benefits of SWOT Analysis - Importance of Self Confidence, Self Esteem, Self Development and Self Introspection.

**UNIT V CREATIVITY AND GOAL SETTING** 6  
Thinking out of the box - Lateral thinking - Positive thinking - Results of smart work - Application of creativities - Short Term and Long Term Goals - Lifetime goals.

**TOTAL: 30 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**

- Learners will recognize the importance of Soft skills in Professional life.
- Improve oral and Listening Skills.
- Enhance students' ability in GDs, Presentations and interviews.
- Develop one's strength in setting of goals and developing creative.
- Become a good team worker in the society.

  
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**TEXT BOOKS:**

1. "SOFT SKILLS", Career Development Centre, Green Pearl Publications, 2015.

**REFERENCES:**

1. Covey Sean, "Seven Habits of Highly Effective Teens", New York, Fireside Publishers, 1998.
2. Carnegie Dale, "How to win Friends and Influence People", New York: Simon & Schuster, 1998.
3. Jeff Butterfield, "Soft Skills for Everyone", Cengage Learning, 2011.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	2	-	2	2	-	-
CO2	-	3	-	3	2	-	3	2	2	2	2
CO3	2	-	-	-	3	-	2	3	2	2	2
CO4	2	-	2	-	-	2	-	3	2	3	-
CO5	-	3	2	1	-	2	2	3	2	-	-

  
CHAIRMAN  
BoS (S&H) 14/10

**OBJECTIVES:****The Student should be made to:**

- Apply the testing of hypothesis for small and large samples which plays an important role in real life problems
- Evaluating the basic concepts of classifications of design of experiments
- Analyze the statistical tools and statistical quality control in engineering problems
- construct an approximate polynomial to represent the data and to find the intermediate values
- Acquaint the knowledge of various techniques and methods of solving ordinary differential equations

**UNIT I TESTING OF HYPOTHESIS 9+3**

Sampling distributions - Estimation of parameters - Statistical hypothesis - large sample test based on normal distribution for single mean and difference of means -small sample tests: t-test for mean - F- test Chi-square test for Goodness of fit and Independence of attributes.

**UNIT II DESIGN OF EXPERIMENTS 9+3**

One way and two-way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design-2<sup>2</sup> factorial design.

**UNIT III STATISTICAL QUALITY CONTROL 9+3**

Control charts for measurements(X and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limit-Acceptance sampling.

**UNIT IV INTERPOLATION AND APPROXIMATION 9+3**

Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Central difference interpolation: Stirling's Formula, Bessel's Formula - Cubic Splines.

**UNIT V BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3**

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

**TOTAL: (45+15) PERIODS**

1/3  
CHAIRMAN  
BoS (S&H) 09/10

**OUTCOMES:**

On successful completion of the course, the students will be able to,

- Applying the concept of testing of hypothesis for small and large samples in real life problems
- Analyzing the basic concepts of classifications of design of experiments
- Apply the limits in quality control to ensure that products meet specified quality standards
- Construct an approximate polynomial to represent the given data and know to find the intermediate values
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

**TEXT BOOKS:**


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2017.
2. Richard A. Johnson., "Probability and Statistics for Engineers", Pearson Education, 8<sup>th</sup> Edition, 2019.

**REFERENCES:**

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2018.
2. O'Neil P.V., "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7<sup>th</sup> Edition New Delhi, 2013.
3. Devore J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2021
4. Spiegel Schiller, "Probability and Statistics" Tata McGraw-Hill Publishing Company Limited, New Delhi. 3<sup>rd</sup> Edition, 2018.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	1	-	-	-	2	-	-	3
CO2	2	3	2	1	-	-	-	2	-	-	3
CO3	2	3	2	1	-	-	-	2	-	-	2
CO4	2	3	2	1	-	-	-	2	-	-	2
CO5	2	3	2	1	-	-	-	2	-	-	2

  
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BoS (S&H) 09/10

**OBJECTIVES:**

**The students should be made to:**

- Understand the construction and performance characteristics of salient and non-salient type synchronous generators
- Acquire knowledge about the principle of operation and performance of synchronous motors
- Examine the construction, principle of operation, and performance of induction machines
- Compare the different methods of starting, speed control and braking of three-phase induction motors
- Analyze the construction, principle of operation and performance of fractional kilowatt induction motors and special machines

**UNIT I      SYNCHRONOUS GENERATORS      9**


Constructional details – Types of rotors – EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing power – Power output equations – Change of excitation and mechanical input – Two reaction theory – Slip test – Claw pole Alternator.

**UNIT II      SYNCHRONOUS MOTORS      9**

Principle of operation – Torque equation – Starting methods – Operation on infinite busbars – V and inverted V curves – Input and output power equations – Power/power angle relations – Hunting – Synchronous condenser – Power factor correction.

**UNIT III      POLY PHASE INDUCTION MOTORS      9**

Constructional details – Types of rotors – Squirrel cage and slip ring – Principle of operation – Slip-Torque equations – Slip-Torque characteristics – Losses and efficiency – Load test – No load and Blocked rotor tests – Equivalent circuit – Separation of No-Load losses – Crawling and

  
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**REFERENCES:**

1. Nagrath I J and Kothari D P, “Electric Machines”, Fifth Edition, McGraw Hill Education, 2018.
2. Bimbhra P S, “Electric Machinery”, Second Edition, Khanna Publishers, 2021.
3. Fitzgerald E, Kingsley C and Stephen D Umans, “Electric Machinery”, Sixth Edition, McGraw Hill Education, New York, 2017.
4. Gupta B R and Vandana Singhal, “Fundamental of Electric Machines,” Revised Third Edition, New age International (P) Ltd. Publishers, 2020.
5. Stephen J Chapman, “Electric Machinery Fundamentals” Fourth Edition, McGraw Hill Education Pvt. Ltd., 2017.
6. Theraja B L and Theraja A K, “A Textbook of Electrical Technology Volume – II: AC and DC Machines”, Twenty Third Edition, S. Chand Limited, 2025.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO2</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO3</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO5</b>	3	3	2	-	-	1	-	-	-	-	2	3	3

  
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**OBJECTIVES:**

The students should be made to,

- Describe the use of transfer function models in representing the dynamic behavior of electrical and mechanical systems
- Familiarize the time domain analysis for various system types and orders
- Perform frequency domain analysis using different graphical methods
- Investigate the role of compensators in enhancing system performance and stability
- Interpret the results of controllability and observability tests in state-space representation

**UNIT I      SYSTEM MODELING AND REPRESENTATION      9**

Introduction – Open loop and closed loop systems – Differential equations and Transfer function – Modelling of Electrical Systems – Modeling of mechanical translational and rotational systems – Analogous system – Block diagram reduction techniques – Signal flow graph.

**UNIT II      TIME DOMAIN RESPONSE      9**

Introduction – Standard test signals – Time response of First-order system and Second-order systems for unit step input signal – Time domain specifications: Rise time, Peak time, Peak Overshoot, Settling Time and Steady state error – Steady state error constants: Position, Velocity and Acceleration error constants – Dynamic error coefficients – Response with P, PI and PID controllers.

**UNIT III      FREQUENCY DOMAIN RESPONSE      9**

Introduction- Frequency response: Bode plot, Polar plot – Determination of closed loop response from open loop response: Constant M and N circles, Nichols Chart – Correlation between frequency and time response of second order systems.

*P. S. Prasad*  
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**UNIT IV STABILITY ANALYSIS AND COMPENSATOR DESIGN 9**

**Stability:** Introduction – Bounded-Input Bounded-Output (BIBO) stability – Necessary and sufficient conditions for stability – Routh stability criteria – Application of the Routh stability criterion to linear feedback systems – Root locus technique: Construction of root locus, Rules for the construction of the root locus

**Compensators:** Introduction – Types and Realization of compensator: Lag, Lead and Lag-Lead compensator – Design of Lag, Lead and Lag-Lead compensators using Bode plot method.

**UNIT V STATE VARIABLE ANALYSIS 9**

Introduction – State space representation of differential equations in physical variable form – State space model representation for Electric circuits and Mechanical System – State space representation of transfer function in canonical forms – Solution of homogeneous state equations – Transfer function from the state-space model – Controllability and Observability.

**TOTAL: 45 PERIODS**


**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Develop mathematical models of electrical and mechanical systems using transfer functions
- Perform time domain analysis to evaluate the transient and steady-state responses of various system types and orders
- Analyze system stability and performance using frequency domain techniques
- Design Lag, Lead, and Lag-Lead compensators using the Bode plot method
- Evaluate the controllability and observability of systems based on their state-space representation.

**TEXT BOOKS:**

1. Nagarath I J and Gopal M, “Control Systems Engineering”, Seventh Edition, New Age International Private Limited, 2021.
2. Katsuhiko Ogata, “Modern Control Engineering”, Fifth Edition, Pearson Education India, 2012.


  
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**REFERENCES:**

1. Salivahanan S, Rengaraj R, Venkatakrishnan GR, “Control Systems Engineering”, First Edition, Pearson Education, 2016.
2. Anand Kumar A, “Control Systems”, PHI Learning Private Limited, Second Edition, 2014.
3. Benjamin C Kuo and Farid Golnaraghi, “Automatic Control Systems”, Eighth Edition, Wiley Student Edition, 2014.
4. Gopal M, “Control Systems – Principles and Design”, Fourth Edition, McGraw Hill Education, 2012.
5. Bhattacharya S K, “Control System Engineering”, Third Edition, Pearson, 2013.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	1	2	3	3
CO2	3	3	2	2	-	-	-	-	-	1	2	3	3
CO3	3	3	2	2	-	-	-	-	-	1	2	3	3
CO4	3	3	2	2	-	-	-	-	-	1	2	3	3
CO5	3	3	2	2	-	-	-	-	-	1	2	3	3

  
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BoS (EEE) 07/04/25

**OBJECTIVES:**

**The students should be made to:**

- Describe various transmission line parameters
- Calculate the electrical performance of overhead transmission lines
- Explain the role of insulators in overhead transmission lines
- Evaluate types of cables, capacitance, and dielectric stress
- Analyze efficient power distribution systems using recent technologies

**UNIT I      ELECTRICAL DESIGN OF TRANSMISSION LINES      9**

Structure of Power System – Parameters of single and three phase transmission lines with single and double circuits – Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition – Application of self and mutual GMD, Skin and proximity effects – Typical configurations and conductor types.

**UNIT II      MODELLING AND PERFORMANCE OF TRANSMISSION LINES      9**

Performance of Transmission lines – Short line, medium line and long line – End Condenser, Nominal T, Nominal  $\pi$  and Rigorous methods – Equivalent circuits, phasor diagram, attenuation constant, phase constant and surge impedance – Transmission efficiency and voltage regulation – Ferranti effect. Real and reactive power flow in lines. Formation of Corona – Critical Voltages – Effect on Line Performance.

**UNIT III      MECHANICAL DESIGN OF TRANSMISSION LINES      9**

Mechanical design of OH lines – Line Supports – Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency – Testing of insulators.

**UNIT IV      UNDER GROUND CABLES      9**

Underground cables – Types of cables – Construction of single core and 3 core cables – Insulation Resistance – Potential Gradient – Capacitance of Single core and three core cables – Grading of cables – Power factor and heating of cables – DC cables.

*R. S. B. K. S.*  
CHAIRMAN  
BoS (EEE) 07/04/25

## UNIT V DISTRIBUTION SYSTEMS

9

Distribution Systems – General Aspects – Kelvin’s Law for the design of feeders – Concentrated and distributed loading – Techniques of Voltage control and power factor improvement – Distribution loss – Types of substations – Methods of grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only) – Interconnected Grid.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**


- Illustrate the significance of transmission line parameters in electrical power transmission
- Calculate the electrical performance of overhead transmission lines
- Analyse voltage distribution, string efficiency and dielectric stress on overhead line insulators
- Evaluate different types of cables, their capacitance, and dielectric stress
- Design an optimized transmission system by recent technologies for efficient power distribution

### TEXT BOOKS:

1. Kothari D P, Nagarith I J, “Power System Engineering”, Third Edition, Mc Graw-Hill Publishing Company limited, New Delhi, 2019.
2. Singh S N, “Electric Power Generation, Transmission and Distribution”, Second Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2011.

### REFERENCES:

1. Rajput R K, “A Text Book of Power System Engineering”, Fifth Edition, Laxmi Publications (P) Ltd, New Delhi, 2016.
2. Wadhwa C L, “Electrical Power Systems”, Seventh Edition, New Age International Ltd, 2022.
3. Arun Ingole, “Power transmission and distribution”, First edition, Pearson Education, 2018.

  
CHAIRMAN  
BoS (EEE)

4. Abhijit Chakrabarti, Soni M L, Gupta P V, Bhatnagar U S, "A Textbook on Power System Engineering", Revised Publications, Dhanpat Rai Publications, 2017.
5. Luces M Fualken berry and Walter Coffe, "Electrical Power Distribution and Transmission", Pearson Education, 2007.
6. Metha V K and Rohit Metha, "Principles of Power Systems", Fourth Revised Edition, S Chand Publishing Private Limited, 2022.

**Mapping of COs with POs, PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO2</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO3</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO4</b>	3	3	2	-	-	1	-	-	-	-	2	3	3
<b>CO5</b>	3	3	2	-	-	1	-	-	-	-	2	3	3

*P. S. Bhowmik*  
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**24EC402      LINEAR INTEGRATED CIRCUITS AND APPLICATIONS      L T P C**  
**(COMMON TO ECE AND EEE)      3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Study the basic structure, characteristics and performance of Op-amp.
- Understand the linear applications of operational amplifiers.
- Acquire the concepts and non-linear applications of Op-amp, analog multipliers and PLL.
- Explore the different types of A/D and D/A converters using op-amps.
- Design waveform generators using op-amp and study some special function ICs.

**UNIT I      BASICS OF OPERATIONAL AMPLIFIERS      9**

Introduction and Classification of ICs - Basic information about Op-amp - Symbol, Power Supply Connection, Ideal Operational Amplifier - Concept of Virtual Ground - Inverting Amplifier – Non-Inverting Amplifier- Voltage Follower - Differential Amplifier- Op-amp Block Diagram- DC Characteristics - AC Characteristics - Frequency Compensation - Open and Closed loop configurations.

**UNIT II      LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS      9**

Scale Changer - Summing Amplifier – Subtractor- Instrumentation Amplifier - Voltage to Current Converter - Current to Voltage Converter – Differentiator – Integrator – Low pass and high pass Butterworth filters - Band pass filters: Wide Band and Narrow Band.

**UNIT III      OP AMP NON-LINEAR CIRCUITS, ANALOG MULTIPLIER AND PLL      9**

Log amplifier - Antilog amplifier - Comparators - Schmitt Trigger - Precision Rectifier - Clippers - Clampers – Analog multiplier IC and Applications - Basic operation of PLL - Voltage Controlled Oscillator - Monolithic PLL IC 565 - Applications of PLL for Frequency Multiplication/Division, Frequency Translation, AM Detection, FM Detection, FSK Demodulation.

**UNIT IV      ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS      9**

Analog and Digital Conversions – Specifications of DAC - D/A Converters: Weighted Resistor type, R-2R Ladder type, Voltage Mode and Current Mode R-2R Ladder types – Basic Sample and Hold Circuit – Specifications of ADC - A/D Converters: Flash type, Successive Approximation type, Dual Slope type - Sigma Delta Modulator.

**UNIT V      WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs      9**

Sine Wave Generators: RC Phase Shift Oscillator, Wien Bridge Oscillator - Multivibrators: Monostable and Astable -Triangular Wave Generator - ICL 8038 Function Generator – Timer IC 555: Functional Description, Monostable operation, Astable operation - IC Voltage Regulators - Fixed Voltage Series Regulator - IC 723 General Purpose Regulator - Optocouplers and Fibre Optic IC.

**TOTAL: 45 PERIODS**

*M. Sharma*  
 CHAIRMAN  
 BoS (ECE)

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the basic building blocks and characteristics of operational amplifiers.
- Apply the operational amplifiers in various linear applications.
- Analyze the behavior of non-linear applications of op-amps and PLL.
- Implement the different types of A/D and D/A Converters using operational amplifiers.
- Construct the waveform generators using operational amplifiers and special function ICs.

**TEXT BOOKS:**

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., Fifth Edition, 2018.

**REFERENCES:**

1. S.Salivahanan & V.S. Kanchana Bhaskaran," Linear Integrated Circuits", Tata McGraw Hill, 2nd Edition,4<sup>th</sup> Reprint, 2016.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2016
3. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4<sup>th</sup> Edition, Prentice Hall / Pearson Education, 2015.
4. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5<sup>th</sup> Edition, 2009.
5. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education,4<sup>th</sup> Edition,2001.

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	2	3	2	-	-	-	-	-	-	1
CO5	3	2	3	2	-	-	-	-	-	-	1

  
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BoS (ECE)

**OBJECTIVES:****The students should be made to:**

- Apply the understanding of fundamental rights and duties to real life situations and legal case studies.
- Illustrate the roles and responsibilities parliamentary framework.
- Analyze the general structure of the state executive roles in the state level.
- Investigate the powers and judicial responsibilities of the higher Judiciary.
- Judge the strength and limitations of India's federal power structure in practice.

**UNIT 1 INTRODUCTION 6**

Historical background - Government of India act - Indian councils act - Making of the constitution - Philosophy of the Indian constitution - Preamble.

**UNIT II GOVERNMENT OF THE UNION 6**

Powers and Functions of President and Prime Minister - Council of Ministers – President in relation to his council - Legislature structure and functions of Lok Sabha and Rajya Sabha - Speaker.

**UNIT III GOVERNMENTS OF THE STATES AND LOCAL GOVERNMENT 6**

The state executive: General structure - Governor - Council of ministers - State legislature. Local government - Panchayat - Municipality - Power authority and responsibilities municipalities.

**UNIT IV THE JUDICATURE 6**

Organization and Composition of Judiciary – Constitution – Appointment - Qualifications - Powers and functions of the supreme court– High courts – Control over subordinate courts.

**UNIT V THE FEDERAL SYSTEM 6**

Distribution of financial powers: Need, principles-Underlying distribution of tax revenues-Distribution of legislative power – Interstate relation - Emergency provisions.

**TOTAL: 30 PERIODS**

**OUTCOMES:****On successful completion of the course, the students will be able to,**

- Distinguish and apply constitutional principles and democratic values of the Indian constitution.
- Emphasize on the powers and interactions of the president, prime ministers in the parliamentary structure.
- Evaluate the structure, powers and functions of state and local governance.
- Demonstrate the Indian judiciary, structure and functions of courts.
- Explore the financial, legislative provisions of Indian federation.

  
 CHAIRMAN  
 BoS (S&H) 20/06/23

**TEXT BOOKS:**

1. Basu D.D, "Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

**REFERENCES:**

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. The Constitution of India, 1950 (Bare Act), Government Publication.
4. Jain M P, Indian Constitution Law, 7<sup>th</sup> Edition. Lexis Nexis, 2014.
5. Busi S N, Ambedkar B R framing of Indian Constitution, 1<sup>st</sup> Edition, 2015.

**Mapping of COs with Pos**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	-	-	-	-	-	3	3	-	-	-	2
<b>CO2</b>	-	-	-	-	-	3	3	2	2	2	3
<b>CO3</b>	-	-	-	-	-	3	3	2	2	2	3
<b>CO4</b>	-	-	-	-	-	3	3	-	2	2	3
<b>CO5</b>	-	-	-	-	-	3	3	-	-	3	2

  
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BoS (S&H)

**OBJECTIVES:**


The students should be made to:

- Calculate the voltage regulation of three-phase alternators under varying operational loads
- Analyse the efficiency and operational characteristics of three phase synchronous machines
- Interpret the performance of three-phase and single phase induction motors
- Create equivalent circuit models for both three phase and single phase induction motors
- Evaluate the performance of induction machines using simulation tools

**LIST OF EXPERIMENTS**

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF method.
3. Regulation of three phase salient pole alternator by slip test.
4. Load test on three phase alternator.
5. V and inverted V curves of three phase synchronous motor.
6. Load test on three phase squirrel cage induction motor.
7. Load test on three phase slip ring induction motor.
8. Load test on single phase induction motor.
9. Separation of No-load losses of three phase induction motor.
10. No load and blocked rotor test on three phase induction motor.
11. No load and blocked rotor test on single phase induction motor.
12. Simulation of Load test on three phase induction motor.
13. Simulation of Load test on single phase induction motor.

**TOTAL: 45 PERIODS**

  
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BoS (EEE) 07/04/25


## OUTCOMES:

At the end of the course, students will be able to,

- Compare the regulation of three phase alternators under different load conditions
- Analyze the operational performance of synchronous generators and motors
- Examine the characteristics of three phase and single phase induction motors
- Develop the equivalent circuits for three phase and single phase induction motors
- Apply simulation techniques to model and predict the performance of induction machines

Mapping of COs with POs, PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	1	-	2	-	-	1	3	3
CO2	3	2	2	-	-	1	-	2	-	-	1	3	3
CO3	3	2	2	-	-	1	-	2	-	-	1	3	3
CO4	3	2	2	-	-	1	-	2	-	-	1	3	3
CO5	3	2	2	-	2	1	-	2	-	-	1	3	3

  
CHAIRMAN  
BoS (EEE)

## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	DC Shunt Motor (7.5HP, 220V, 1500 RPM) coupled with 3-phase Alternator (5KVA, 415V)	4
2.	Three Phase Squirrel Cage Induction Motor (5HP, 440V, 1500 RPM) with loading arrangement	3
3.	Three Phase Slip Ring Induction Motor (5HP, 1500 RPM) with loading arrangement	1
4.	Synchronous Motor (5HP, 415V, 6.5A, 1500RPM) with loading arrangement	1
5.	Single Phase Induction Motor (2HP, 230V, 10A) with loading arrangement	2
6.	Single Phase Resistive Load	7
7.	Three Phase Resistive Load	3
8.	Three Phase Inductive Load	1
9.	Three Phase Autotransformer (440V, 6A)	4
10.	Single Phase Autotransformer (230V, 6A)	9
11.	Tachometers Digital/Analog	10
12.	Rheostat of various ranges	As required
13.	MI/MC Voltmeter	As required
14.	MI/MC Ammeter	As required
15.	UPF/LPF Wattmeter	As required

*P. S. Rao*  
 CHAIRMAN  
 BoS (EEE) 26/05/25

**OBJECTIVES:****The student should be made to:**

- Understand the principles of Boolean functions and combinational logic circuits
- Interpret the circuit behaviour of counter and sequential logic ICs
- Apply the concepts of operational amplifier configurations to design inverting, non-inverting amplifiers and comparators
- Implement the integrators, differentiators, and voltage regulators using operational amplifier ICs
- Construct regulators and multivibrators using IC555 and IC LM317

**LIST OF EXPERIMENTS:**

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Binary to Gray code converter and vice-versa.
3. Encoders and Decoders.
4. Multiplexer and demultiplexer.
5. Parity generator and parity checker.
6. Design and implementation of synchronous and Asynchronous counter types using FF IC's and specific counter IC.
7. Inverting, Non-inverting amplifier and comparator.
8. Integrator and Differentiator.
9. Schmitt trigger using operational amplifier.
10. Instrumentation amplifier using operational amplifier.
11. Multivibrators using IC555 Timer.
12. Variability Voltage Regulator using IC LM317.

**TOTAL: 45 PERIODS**

  
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BoS (ECE) 11/04/25

## OUTCOMES:

On successful completion of this course, the student will be able to,

- Explain the principles of Boolean functions and combinational logic circuits
- Design and test the circuit behaviour of counter and sequential logic ICs
- Compare the performance of inverting, non-inverting amplifiers, and comparators
- Analyse the performance of integrators, differentiators, Schmitt triggers, and instrumentation amplifiers
- Develop voltage regulators and multivibrators using IC555 and IC LM317

Mapping of COs with POs, PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	1	-	2	-	-	1	3	3
CO2	3	2	2	-	-	1	-	2	-	-	1	3	3
CO3	3	2	2	-	-	1	-	2	-	-	1	3	3
CO4	3	2	2	-	-	1	-	2	-	-	1	3	3
CO5	3	2	2	-	2	1	-	2	-	-	1	3	3

  
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BoS (ECE)

## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required (Nos)
1.	Dual Regulated Power Supply 0 to 30V	10
2.	Function Generator 2MHZ	10
3.	CRO or DSO	10
4.	Digital Multimeter	5
5.	IC Tester	2
6.	Necessary ICs	Each 30
7.	Bread Board	10

  
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BoS (ECE) 06/05/25

**24EEC401L LIFE SKILLS AND PERSONALITY DEVELOPMENT**  
**(Common to All Branches)**

**L T P C**  
**0 0 2 1**

**OBJECTIVES:**

**The students should be made to:**

- Create self- confident among the students by the training
- Develop good personality for mature outlook in different circumstances
- Encourage effective presentation skills
- Dramatize role play by assigning the best role
- Enhance team building and time management skills

**UNIT I CAREER PLANNING 6**  
Introduction - Benefits of Career Planning - Expectation and Development - Guidelines for choosing a Career - Future planning - Evaluation of planning.

**UNIT II ATTITUDE 6**  
Introduction - Rightness of Attitude and behaviour - Formation of Attitudes - Evolving Behaviour of a person - Creating right attitudes - Approaches of Challenges - Lessons from Attitude.

**UNIT III ROLE PLAYING 6**  
Introduction - settings of role plays - Principles and Purpose - importance of communication in role plays - Arrangement of points and character - Extempore Talk - Debates - Emotional Intelligence.

**UNIT IV TEAM BUILDING 6**  
Purpose of Creating Team - Exploring Team roles and Processes - Importance of Building and Developing Strong Team - Leadership Qualities - Success of Team Building.

**UNIT V TIME MANAGEMENT 6**  
Value of time - Concept and applications of time management - Causes for wasting of time - Methods of Time Management - Diagnosing Time Management - Planning for presentation - To - do - list - Prioritizing work

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Improve the leadership skills by identifying the strengths of a team
- Learn to lead a team on a project in an organization
- Helps students to perform on a distinct role and learn to face the challenges
- Build a strong team to achieve their goals with the right choice of people
- Develop the time management skills to achieve success

  
CHAIRMAN  
BoS (S&H) 14/10

**TEXT BOOKS:**

1. "Soft Skills", Career Development Centre, Green Pearl Publications, 2015.

**REFERENCES:**

1. Thomas A Harris, "I Am Ok, You Are Ok", Harper and Row, New York 1972.
2. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.
3. Nira Konar, "Communication Skills for Professionals", Eastern Economy Edition, 2010.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	1	2	2	1	1	2	3	1	3
CO2	1	2	1	2	2	1	1	2	3	1	3
CO3	1	2	1	2	2	1	1	3	3	1	3
CO4	1	2	1	2	2	1	1	3	3	1	3
CO5	1	2	1	2	2	1	1	3	3	1	3

  
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BoS (S&H) 14/10

24EE501

**POWER SYSTEM ANALYSIS**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Know power system structure and per-unit modelling
- Analyze power flow using classical and numerical methods
- Perform symmetrical fault analysis for balanced fault conditions
- Understand unsymmetrical fault analysis using symmetrical components
- Calculate power system stability using swing equation and numerical methods

**UNIT I INTRODUCTION**

**9**

Structure of Power system – Basic Components of a power system and its modelling – Single line diagram – Impedance diagram – Reactance diagram – Per Phase Analysis – Per unit system – Simple bus building algorithms for the formation of Y-Bus matrix.

**UNIT II POWER FLOW ANALYSIS**

**9**

Importance of power flow analysis in planning and operation of power systems – Statement of power flow problem – Bus Classifications – power flow solution methods – Gauss Seidal method – Newton Raphson method (polar form) – Fast decoupled method (qualitative study only) – Flow charts – Comparison.

**UNIT III SYMMETRICAL FAULT ANALYSIS**

**9**

Need of short circuit analysis – Symmetrical three phase fault– Short circuit capacity– Bus building algorithm for formulation of Z bus matrix – systematic fault analysis using bus impedance matrix.

**UNIT IV UNSYMMETRICAL FAULT ANALYSIS**

**9**

Fundamentals of symmetrical components – Sequence impedances – Sequence networks representation – Single line to ground fault – Line to line fault – Double line to ground fault.

**UNIT V POWER SYSTEM STABILITY ANALYSIS**

**9**

Importance of stability analysis in power system planning and operation – Types of stability – Basic concepts and definitions – Rotor angle stability – Swing equation – Solution of swing equation by step-by-step method – An elementary view of transient stability – Equal area criterion – Critical clearing angle and time – Numerical integration methods (Algorithm and flow chart) for multi-machine stability analysis – Euler method – Modified Euler method.

**TOTAL: 45 PERIODS**

*R.P. Choudhary*  
**CHAIRMAN**  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Model power system elements and draw per-unit and bus diagrams
- Solve power flow problems using standard methods
- Analyze symmetrical faults and calculate fault currents
- Apply symmetrical components to analyse unsymmetrical faults
- Evaluate system stability using swing equation and numerical method

**TEXT BOOK:**

1. John J Grainger and WD Stevenson Jr., “Power System Analysis”, McGraw Hill International Book Company, 2015.

**REFERENCES:**

1. Nagrath I J and Kothari D P, “Modern Power System Analysis”, Fifth Edition, McGraw-Hill Publishing Company, New Delhi, 2022.
2. Hadi Saadat, “Power System Analysis”, Twenty First Reprint, McGraw Hill Publishing Company, 2010.
3. Wadhwa C L, "Electrical Power Systems", Seventh Edition, New Age International Publishers, January 2016.
4. Olle I Elgerd, “Electric Energy Systems Theory – An Introduction”, Second Edition, McGraw Hill Publishing Company Limited, July 2017.
5. Kundur P, “Power System Stability and Control”, McGraw Hill Publications, 2013.
6. Pai M A, “Computer Techniques in Power System Analysis”, McGraw – Hill Publishing Company, 2017.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	1	1	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	3	3	2

*PSP*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the characteristics, types and operation of power semiconductor devices
- Analyze the functioning, response and performance parameters of controlled rectifiers
- Learn the operation, switching strategies, topologies and applications of DC-DC switching regulators
- Examine PWM inverter modulation techniques, harmonic reduction methods and their applications
- Evaluate the operation and applications of AC voltage controllers and cycloconverters

**UNIT I UNCONTROLLED RECTIFIER 9**

Introduction – Power Diode – Switching Characteristics – Types. Single phase diode rectifier: Half and Full wave diode rectifier – Three phase rectifiers – Multiphase Diode rectifier.

**UNIT II AC TO DC CONVERTER 9**

SCR: Characteristics – Turn on methods – Switching Characteristics – Two transistor model – Operation and analysis of 2-pulse, 3-pulse and 6-pulse converters with R and RL loads – Turn off methods – Performance Characteristics – Power Factor – Applications: Solar PV systems.

**UNIT III DC TO DC CONVERTER 9**

BJT – Power MOSFET – N and P-Channel MOSFETs – Silicon Carbide MOSFET – Step-down and Step-up chopper – Time ratio control and Current limit control – Principle of operation of buck, boost, buck-boost and cuk regulators – MOSFET Gate Driver Circuits – Applications: Battery operated vehicles.

**UNIT IV DC TO AC CONVERTER 9**

IGBT – Single phase half bridge and full bridge inverters – Three Phase Inverters (both 120° and 180° mode) – PWM Techniques: Single, multiple, sinusoidal PWM and space vector modulation – Harmonics Reduction – Applications: Induction heating.

**UNIT V AC TO AC CONVERTER 9**

Principle of Phase and Integral cycle control – Single phase AC voltage controller – Single and multi-stages sequence control – Cycloconverter: Single phase to single phase, three phase to single phase and three phase to three phase – Output equation – Applications: Welding.

**TOTAL: 45 PERIODS**

*P. S. S. S.*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Describe the characteristics, types, and operation of power semiconductor devices
- Analyze the performance of SCR-based converters for various loads
- Apply switching strategies and topologies of DC–DC converters in practical applications
- Demonstrate the operation of inverters and evaluate PWM techniques for harmonic reduction
- Assess the operation and applications of AC voltage controllers and cycloconverters

**TEXT BOOKS:**

1. Bimbhra P S, “Power Electronics”, Seventh Revised Edition, Khanna Publishing House, 2025.
2. Rashid M H, “Power Electronics: Circuits, Devices and Applications”, Fourth Edition, Pearson Education, New Delhi, 2018.

**REFERENCES:**

1. Ashfaq Ahmed, “Power Electronics for Technology”, Third Edition, Pearson Education, Indian reprint, 2003.
2. Philip T Krein, “Elements of Power Electronics” Oxford University Press, 2004 Edition.
3. Umanand L, “Power Electronics Essentials and Applications”, Wiley, 2010.
4. Ned Mohan Tore M Undel and William P Robbins, “Power Electronics: Converters, Applications and Design”, Third Edition, John Wiley and sons, 2003.
5. Singh M D and Khanchandani K B, “Power Electronics,” Mc Graw Hill India, 2013.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	–	–	–	–	–	–	1	3	3
<b>CO2</b>	3	3	1	2	–	–	–	–	–	–	2	3	3
<b>CO3</b>	3	3	2	1	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	2	2	–	–	–	–	–	–	2	3	3

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:****The students should be made to:**

- Learn the characteristics of measuring instruments
- Explain various measurement techniques using analog instruments
- Discuss different methods of AC and DC bridges
- Analyze the working and applications of various transducers and sensors for measurement of physical quantities
- Understand the performance and applications of digital instruments

**UNIT I MEASUREMENT CONCEPTS 6**

Instruments: classification, applications – Elements of a generalized measurement system – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Calibration.

**UNIT II ANALOG INSTRUMENTS 6**

Introduction to analog measuring instruments – Construction, principle and applications of Moving coil instrument – Moving iron instrument – Dynamometer type instrument – Instrument transformers (CT and PT).

**UNIT III AC AND DC BRIDGES 6**

D.C potentiometers, DC bridges (Wheatstone, Kelvin and Kelvin double bridge) and AC bridges (Maxwells and Schering bridges) – Errors and compensation in AC bridges.

**UNIT IV TRANSDUCERS 6**

Classification of transducers – Measurement of pressure, temperature and displacement – Digital transducers – Smart Sensors.

**UNIT V DIGITAL INSTRUMENTATION 6**

A/D converters: types and characteristics – Sampling, Errors – Measurement of voltage, Current, frequency and phase. D/A converters: types and characteristics – Delta-Sigma Convertors – DSO...

**THEORY: 30 PERIODS**

**LIST OF EXPERIMENTS:**

1. Calibration of analog voltmeter, ammeter and wattmeter.
2. Measurement of high voltage and current using potential transformer (PT) and current transformer (CT).
3. Measurement of DC resistance using a Wheatstone and Kelvin double bridge.
4. Measurement of inductance using Maxwell's bridge.
5. Measurement of capacitance using a Schering bridge.
6. Measurement of displacement using an LVDT.
7. Measurement of temperature using an RTD and thermistor.
8. Measurement of pressure using a Bourdon tube.
9. Analog-to-digital and Digital-to-analog conversion.

**PRACTICAL: 30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**


- Explain the characteristics of measuring instruments and the types of errors that occur
- Analyze the performance of deflecting type instruments
- Compare different methods employed in AC and DC bridges
- Apply the concepts of transducers in different measuring instruments
- Demonstrate the performance and applications of digital instruments

**TEXT BOOK:**

1. Sawhney A K, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Company, 2019.

**REFERENCES:**

1. Kalsi H S, "Electronic Instrumentation", Third Edition, McGraw Hill, 2017.
2. Murthy D V S, "Transducers and Instrumentation", Prentice Hall of India Private Limited, 2015.
3. David Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 2013.
4. Rajput R K, "Electrical and Electronic Measurements and Instrumentation", S Chand and Company, 2016.
5. Helfrick A D and Cooper W D, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India Private Limited, 2016.

  
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**BoS (EEE)**

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	-	-	-	-	-	-	1	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	2	2
CO4	3	2	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	-	-	-	-	-	-	2	2	2

*P. P. Prasad*  
**CHAIRMAN**  
 BoS (EEE) 16/10/25

**24EC401      MICROPROCESSORS AND MICROCONTROLLERS      L T P C**  
**(COMMON TO ECE, EEE & BME)      3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the evolution and features of the 8086 microprocessor.
- Analyse the role of various instruction sets in execution control.
- Design the semiconductor memory is interfaced with the 8086 microprocessor.
- Develop assembly language programs for data transfer, arithmetic, and logical operations in 8051
- Analysis the impact of waveform generation techniques on hardware control.

<b>UNIT I      ARCHITECTURE SIGNALS AND FEATURES</b>	<b>9</b>
Introduction: History of computers, Block diagram of a microcomputer, Intel 80x86 evolutions, Features of 8086 microprocessor, register organization of 8086, Architecture of 8086, Instruction queue and pipelining, Segmentation of memory used with 8086, Methods of generating physical address in 8086, Pin signals of 8086, Common signals, Minimum mode signals with timing diagram, Maximum mode signals with timing diagram	
<b>UNIT II      PROGRAMMING IN 8086</b>	<b>9</b>
Addressing modes of 8086, Data Transfer Instructions, Data Conversion Instructions, Arithmetic Instructions, Logical instructions and Processor control instructions, String instructions, Branch Instructions Example programs, Assembly Language Programming of 8086, Stack structure, Interrupt structure	
<b>UNIT III      8086 INTERFACING WITH MEMORY AND PROGRAMMABLE DEVICES</b>	<b>9</b>
Semiconductor memory interfacing, Dynamic RAM interfacing, Interfacing program memory and data Memory with 8086, Programmable Peripheral Interface 8255, ADC with programming, DAC with programming, 8254 with programming, 8259 with programming, 8279 with programming, 8251 USART, 8257, Stepper Motor interfacing	
<b>UNIT IV      8051 ARCHITECTURE AND ASSEMBLY PROGRAMMING</b>	<b>9</b>
Differences between microprocessor and microcontroller, 8-bit microcontrollers, and feature of 8051 microcontroller, Architecture of 8051, Signal descriptions of 8051, Register set of 8051, Operational features of 8051, Memory and I/O addressing, Interrupts and Stack, Addressing modes, Arithmetic and Logical Instructions, Data Transfer Instructions, Boolean Variable Instructions and Branch Instructions, Assembly Language Programming	
<b>UNIT V      8051 INTERACING AND EMBEDDED PRGOGRAMMING</b>	<b>9</b>
Parallel ports, Timer, Interrupts, serial port, Push-button, Matrix keypad, LED, 7- segment, LCD displays, DAC, ADC, DC motor, Stepper motor, Servo motor	

**TOTAL: 45 PERIODS**

  
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 BoS/ECE

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the architecture and features of the 8086 microprocessor
- Develop assembly language programs using 8086 instructions
- Interface 8086 with memory and peripheral devices
- Demonstrate the architecture and programming of the 8051 microcontroller
- Interface and control waveform generators and special function ICs

**TEXT BOOKS:**

1. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 - Microcontroller and Embedded systems", 7<sup>th</sup> Edition, Pearson Education, 2011.
2. Douglas.V.Hall, "Microprocessor and Interfacing: Programming and Hardware", 3<sup>rd</sup> edition, McGraw Hill, 2015
3. Kenneth. J. Ayala, "8051 Microcontroller Architecture, Programming and Applications", 3<sup>rd</sup> edition, Thomson, 2007

**REFERENCES:**

1. Subrata Ghoshal "8051 Microcontroller Internals Instructions, Programming and Interfacing", 2<sup>nd</sup> edition Pearson, 2010
2. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086/8088 family- Architecture, programming and design", 2<sup>nd</sup> edition, Prentice Hall of India, 2007

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	1	-
CO3	3	3	3	2	3	1	-	-	1	2	-
CO4	3	2	2	1	2	-	-	-	-	-	-
CO5	3	2	3	2	3	1	-	-	2	2	1

  
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**COURSE OBJECTIVES:**

The students should be made to:

- Study the characteristics of SCR, TRIAC, MOSFET and IGBT
- Design AC to DC converter circuits for specific applications
- Describe the characteristics and operation of DC to DC converters
- Illustrate the functioning of AC to AC converters
- Model and evaluate power electronic circuits using suitable simulation tools

**LIST OF EXPERIMENTS:**

1. Characteristics of SCR and TRIAC.
2. Characteristics of MOSFET.
3. Characteristics of IGBT.
4. Single-phase AC to DC half-controlled and fully-controlled converter.
5. Three-phase AC to DC half-controlled and fully-controlled converter.
6. MOSFET-based step-down and step-up choppers.
7. IGBT-based single-phase PWM inverter.
8. SCR-based AC voltage controller.
9. Simulation of a single-phase semi and fully controlled rectifier with R and RL load.
10. Simulation of a chopper-fed DC motor drive.
11. Simulation of a three-phase full converter with R load.
12. Study of driver circuits and signal conditioning.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Determine the characteristics of SCR, TRIAC, MOSFET and IGBT
- Understand the working and performance of AC to DC converters
- Assess the performance of DC to DC converters
- Interpret the operating principles of AC to AC converters
- Develop and simulate power electronic circuits using suitable software tools

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	–	–	–	–	–	1	3	2
CO2	3	3	2	2	2	–	–	–	–	–	1	3	2
CO3	3	3	3	2	2	–	–	–	–	–	1	3	2
CO4	3	3	2	2	2	–	–	–	–	–	1	3	2
CO5	3	3	3	3	3	–	–	–	–	–	2	3	2

*P. S. Sankar*

CHAIRMAN

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**24EC404L MICROPROCESSOR AND MICROCONTROLLER  
LABORATORY  
(COMMON TO ECE, EEE & BME)**

**L T P C  
0 0 3 1.5**

**OBJECTIVES:**

**The student should be made to:**

- Simulate and analyze 8086 programs using MASM
- Implement interfacing of peripheral devices with 8086
- Design and develop DAC, ADC, DC motor in 8086
- Design and implement assembly programming in 8051 for general-purpose computing
- Develop embedded C programs to interface peripheral devices with 8051/89s52

**LIST OF THE EXPERIMENTS**

1. Simulation of 8086 using MASM Software (Data Transfer Instructions, Data Conversion Instructions, Arithmetic Instructions, Logical instructions and Processor control instructions, String instructions)
2. Interfacing 8255 with 8086
3. Interfacing 8251 with 8086
4. Interfacing 8279 with 8086
5. Interfacing DAC & ADC with 8086.
6. Interfacing DC motor & stepper motor with 8086
7. General Purpose Programming in 8051(Arithmetic and Logical Instructions, Data Transfer Instructions, Boolean Variable Instructions)

**Embedded C Programming**

8. Interfacing LED, 7- segment with 8051/ 89s52
9. Interfacing input devices Matrix Keypad in 8051/89s52
10. Interfacing DC motor & stepper motor with 8051/ 89s52
11. Interfacing DAC & ADC with 8051/89s52
12. Programming Timer & Counter in 8051/89s52
13. Programming Serial Communication in 8051/89s52

**TOTAL: 45 PERIODS**

**OUTCOME:**

**On successful completion of this course, the students will be able to,**

- Demonstrate the simulation of 8086 microprocessor instructions using MASM software and analyze its data processing capabilities.
- Interface and configure peripheral devices (8255, 8251, 8279, DAC, ADC, DC motor, and stepper motor) with the 8086 microprocessor and evaluate their performance.
- Develop and implement general-purpose programs using 8051 microcontroller instructions and Embedded C programming for various applications.
- Design and test interfacing of various input/output devices (LED, 7-segment display, matrix keypad, motors, ADC, DAC) with 8051/89s52 microcontrollers
- Analyze and implement timer, counter and serial communication programming in the 8051/89s52 microcontroller for real-time embedded applications.

  
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 BOS/ECE

### MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	2	3	-	-	-	-	-	1
CO2	3	3	2	2	3	1	-	-	-	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-
CO4	3	2	3	2	3	-	-	-	-	-	1
CO5	3	3	2	2	3	1	-	-	-	-	1

  
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 BOS/ECE

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. 8086 microprocessor trainer -(10 Nos)
2. 8051 microcontroller trainer - (10 Nos)
3. 80s52 Micro controller trainer-(10 Nos)
4. Interface with 8251.8255 &8279 kits - (Each 2 Nos)
5. DAC \ ADC Interface - (2 Nos)
6. Stepper motor Interface- (2 Nos)
7. Standalone desktops PC - (15 Nos)
8. MASM Simulation Software: (any public domain or commercial software)

  
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BoS /ECE 16/10/25

**OBJECTIVES:**

The student should be made to:

- Identify suitable project topics relevant to the field of engineering
- Apply core engineering concepts to develop practical and effective solutions
- Demonstrate creativity in the design and implementing project ideas
- Illustrate skills in teamwork, leadership and project management
- Summarize project outcomes effectively through technical reports and presentations

The students work in groups of up to three members on a topic approved by the Head of the Department, under the guidance of a faculty member. They prepare a comprehensive project report after completing the work to the satisfaction of their supervisor. Project progress is evaluated through a minimum of three reviews. Each review committee shall have at least three members, with the guide serving as an additional member who must be present during the presentation of their group. The project report should be prepared and submitted to the Head of the Department by the end of the semester. Evaluation of the project work is based on both the oral presentation and the project report, assessed jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Analyze an engineering problem and define specific objectives
- Formulate an efficient and technical solution to the identified problem
- Evaluate results and validate the effectiveness of the proposed solution
- Develop effective teamwork as a member of a multidisciplinary project team
- Create project work professionally using appropriate technical formats and standards

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	–	–	–	–	–	2	3	2
CO2	3	3	2	2	3	2	–	–	–	2	2	3	2
CO3	3	3	3	2	2	2	–	–	–	2	2	3	3
CO4	3	3	3	2	1	–	2	3	3	3	2	3	3
CO5	3	3	3	3	2	–	–	2	2	2	2	3	3

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28/10/25

**24EEC501L PROFESSIONAL SKILLS AND CAREER DEVELOPMENT**  
**(Common to All Branches)**

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**OBJECTIVES:**

**The student should be made to:**

- Analyze problems effectively using critical thinking skills.
- Use language effectively with commitment and cooperation.
- Enrich creative thinking and presentation skills to meet industry requirements.
- Develop and enhance soft skills through individual and group activities.
- Acquire the right attitude and behavioral traits for personal and professional development.

**UNIT I INTRODUCTION TO BASIC ARITHMETIC AND PERSONALITY TRAITS**

**6**

Aptitude - Numbers, Average, Percentage, Profit and loss, Picture pattern.

Soft skills - Personality development, Professional ethics, Perception insights, attitude and behavioral changes.

**UNIT II CONCEPT OF PROPORTIONALITY & INTERPERSONAL SKILLS**

**6**

Aptitude - Time and work, Pipes and cisterns, Series completion, Critical reasoning.

Soft skills - Developing self - esteem, Significance of interpersonal behaviour and interpersonal relationships.

**UNIT III AN APPROACH TO COGNITIVE APTITUDE AND LEADERSHIP SKILLS**

**6**

Aptitude - Time, speed and distance, Boats and streams, Races and games, Syllogism.

Soft skills - Leadership skills - Characteristics and importance of leadership, Roles and responsibilities of a good Leader

**UNIT IV CONTEMPORARY APTITUDE AND SITUATIONAL RESPONSES**

**6**

Aptitude - Crypt arithmetic, Ranking, Logarithms, Cubes, Analogy.

Soft skills - Decision making - Processes and challenges, Creative and Critical thinking.

**UNIT V NON-VERBAL REASONING AND INFLUENCING OTHERS**

**6**

Aptitude - Clocks, Non - verbal reasoning, Permutation, Classifications.

Soft skills - Presentation skills - Make use of visual aids with modern tools, Insights on persistence and perseverance.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Ability to solve both analytical and logical problems in an effective manner
- Practice to organize and convey the information in such an optimistic way.
- Deliver a professional and constructive presentation
- Recognize explicit assumptions and their consequences
- Access the needed information effectively and efficiently.

  
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**TEXT BOOKS:**

1. Aggarwal R S, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing New Delhi, Revised Edition Oct 2024.
2. Agna Fernandez, "Generic Skills for Employability", Cambridge Publisher, Revised Edition, 2023.

**REFERENCES:**

1. Dr. Soma Mahesh Kumar, Soft Skills: "Enhancing Personal and Professional Success", McGraw Hill Education; First Edition, 2023
2. Aashish Arora, "Quanta Quantitative Aptitude" Kiran Institute of Career Excellence Pvt. Ltd, April 2022.

**Useful Weblinks:**

1. <https://www.bbc.co.uk/learningenglish/>
2. <https://www.cambridgeenglish.org/test-your-english/>

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	3	2	3	1	1	1	3	2	1	2
CO2	2	1	1	1	1	2	2	2	2	1	2
CO3	2	3	2	2	2	3	2	3	3	1	2
CO4	2	3	2	3	3	2	1	3	2	3	2
CO5	1	1	2	2	3	1	2	3	3	1	2



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**OBJECTIVES:****The students should be made to:**

- Analyze the fundamentals of power system operation, load characteristics, reserve requirements and load forecasting using curve-fitting techniques
- Evaluate the static and dynamic behavior of single-area and multi-area Load Frequency Control (LFC) systems
- Assess the performance and principles of reactive power generation, absorption and voltage control methods
- Apply lambda iteration, base-point and participation factor methods to solve economic dispatch and unit commitment problems
- Evaluate the necessity and functions of computer-based control, SCADA and Energy Management Systems (EMS) in power systems

**UNIT I FUNDAMENTALS OF POWER SYSTEM OPERATION AND CONTROL****9**

Requirements of a good power system – System load variation: System load characteristics, Load curve, Load duration curve, Load factor and diversity factor. Reserve requirements: Installed reserve, Spinning reserve, Cold reserve and Hot reserve. Importance of load forecasting – Quadratic and exponential curve fitting techniques for load forecasting. Necessity of voltage and frequency regulation – P-f and Q-V control loops – Plant-level and system-level control.

**UNIT II ACTIVE POWER – FREQUENCY CONTROL****9**

Fundamentals of speed governing mechanism and modeling – Speed-load characteristics – Load sharing between two synchronous machines operating in parallel; Concept of control area – Load Frequency Control (LFC) of a single-area system: Static and dynamic analysis. Multi-area systems: Two-area system modeling – Static analysis – Tie-line power flow and frequency bias control of a two-area system. State variable model.



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### **UNIT III REACTIVE POWER – VOLTAGE CONTROL**

9

Generation and absorption of reactive power – Fundamentals of reactive power control – Automatic Voltage Regulator (AVR) and Brushless AC excitation system – Block diagram representation of AVR loop – Static and dynamic analysis of AVR loop – Stability compensation – Voltage drop in transmission line – Methods of reactive power injection: Tap-changing transformer, Static VAR Compensator (SVC: TCR + TSC) and STATCOM for voltage control.

### **UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH**

9

Statement of economic dispatch problem – Input-output characteristics of thermal plants – Incremental cost curve – Optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) – Lambda ( $\lambda$ ) iteration method – Base-point and participation factors methods. Statement of Unit Commitment (UC) problem – Constraints on UC – Solution of UC using the Priority List method – Special aspects of short-term and long-term hydrothermal scheduling.

### **UNIT V COMPUTER CONTROL OF POWER SYSTEMS**

9

Need of computer control of power system – Concept of energy control centers and functions – PMU system monitoring, Data acquisition and controls – System hardware configurations – SCADA and EMS functions – State estimation – Measurements and errors – Weighted least square estimation – Various operating states – State transition diagram.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**After completion of course, the students should be able to,**

- Examine power system operations through the analysis of load curves, reserve requirements and forecasting techniques
- Analyze the static and dynamic performance of single-area and two-area LFC systems
- Apply block diagram representation techniques to determine the static and dynamic behavior of the AVR loop
- Evaluate optimal generation schedules using economic dispatch methods and unit commitment solutions

  
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**BoS (EEE)**

- Design a framework for computer-based power system monitoring and control, incorporating SCADA and state estimation

**TEXT BOOKS:**

1. Allen J Wood and Bruce F Wollen berg and Gerald B Sheble, “Power Generation, Operation and Control’, Third Edition, John Wiley & Sons, Inc., 2016.
2. Abhijit Chakrabarti and Sunita Halder, “Power System Analysis Operation and Control”, Third Edition, PHI learning Private Limited, New Delhi, 2010.

**REFERENCES:**

1. Kothari D P and Nagrath I J, “Power System Engineering”, Third Edition, Tata McGraw–Hill Education, 2019.
2. Hadi Saadat, “Power System Analysis”, Twenty First Reprint, McGraw Hill Education Private Limited, New Delhi, 2010.
3. Kundur P, “Power System Stability and Control”, Tenth Reprint, McGraw Hill Education Private Limited, New Delhi, 2010.
4. Olle I Elgerd, “Electric Energy Systems Theory – An Introduction”, Thirty Fourth Reprint, McGraw Hill Education Private Limited, New Delhi, 2010.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	1	–	–	–	–	–	–	–	2	3	1
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	2	–	–	–	–	–	–	2	3	2

*Dr. Anurag K. S.*  
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**OBJECTIVES:**

**The students should be made to:**

- Describe the fundamental concepts of power system protection, relay characteristics, Overvoltage protection and Insulation coordination
- Analyze the operating principles and performance of various relays, including overcurrent, differential, directional and distance protection
- Apply specific protection schemes for electrical apparatus such as generators, transformers, motors, feeders and busbars
- Summarize the principles of circuit interruption and the operational characteristics of various circuit breakers and fuses
- Compare the static and numerical protection techniques utilized in modern substation environments

**UNIT I      INTRODUCTION      9**

**Protection fundamentals:** Terms and definitions, Need for protective Systems – Faults: Causes, types and effects – Essential qualities of protection – Protective relays – Basic terminology, Operating principles, Performance and components – Protective schemes – Torque equation – R-X diagram – Current and voltage transformers for protection.

**Overvoltage Protection and Insulation Coordination:** Causes of overvoltages – Lightning phenomena – Protection of transmission lines – Protection of sub-stations from direct strokes – Insulation Coordination – Basic Insulation Level (BIL).

**UNIT II      RELAY FUNDAMENTALS      9**

**Relay:** Terms and definitions, Differential protection – Principles, Simple differential protection, Over current relays – Current setting, time setting, Overcurrent protective schemes – Reverse power or directional relay – Earth fault and phase fault protection, Distance protection – Impedance relay, Reactance relay, MHO relay, Under frequency and negative sequence relay – Introduction to solid State Relays.

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**UNIT III APPARATUS PROTECTION 9**

Generator – Types, Stator and rotor protection, Motor – Stator and rotor protection, Transformer – Faults, Buchholz relay – Earth fault protection, Busbar protection – Bus protection requirements, differential current protection, Feeder protection – Over-current, distance, pilot wire and carrier current protection – Zones of Protection. Selection of protective devices for a specific requirement.

**UNIT IV CIRCUIT BREAKERS AND FUSES 9**

Circuit breakers: Terms and definitions, Arc phenomenon – Restriking and recovery voltage – Resistance switching – Current chopping – Classification of circuit breakers: Construction and working principle of Oil, Air blast, SF<sub>6</sub> and Vacuum circuit breakers – Rating and selection of Circuit breakers.

Fuses: Conventional Fuses, Types, Characteristics, – Operation, Application – Selection of Fuses – Comparison between fuses and circuit breakers.

**UNIT V STATIC AND NUMERICAL PROTECTION 9**

Static relays: Comparison between Electromechanical and Numerical Relays – Phase, Amplitude comparators – Synthesis of various relays using static comparators.

Microprocessor-based numerical relays – Overcurrent, Impedance, Directional and Reactance relays.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the principles and performance characteristics of protective relays and protection schemes
- Formulate a distance protection strategy by modelling torque equations and R-X diagrams for complex transmission lines
- Implement suitable protection schemes for generators, motors, transformers and busbars based on specific fault requirements
- Evaluate the arc interruption performance of circuit breakers and select suitable circuit breakers and fuses
- Assess the working principles and performance of static and numerical relays compared to electromechanical versions

  
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**TEXT BOOKS:**

1. Badri Ram and Vishwakarma B H, “Power System Protection and Switchgear”, Third Edition, New Age International Private Limited Publishers, 2023.
2. Anderson P M, “Power System Protection”, Wiley Interscience – IEEE Press, Power Engineering Society, 2012.

**REFERENCES:**

1. Sunil S Rao, “Switchgear and Protection”, Khanna Publishers, New Delhi, 2019.
2. Rabindranath B and Chander N, “Power System Protection and Switchgear”, First Edition, New Age International (P) Limited, 2011.
3. Metha V K, “Principles of Power Systems”, Fourth Edition, S. Chand and Co., New Delhi, 2018.
4. Paithankar Y G and Bhide S R, “Fundamentals of Power System Protection”, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2010.
5. Wadhwa C L, “Electrical Power Systems”, Sixth Edition, New Age International Private Limited, 2010.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	–	–	–	–	–	–	–	1	2	1
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	1	2	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	2	2
<b>CO4</b>	3	3	2	2	–	–	–	–	–	–	2	2	2
<b>CO5</b>	3	3	2	2	–	–	–	–	–	–	3	2	2

*P. S. Chakraborty*  
**CHAIRMAN**  
**BoS (EEE)**  
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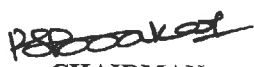
**COURSE OBJECTIVES:****The students should be made to:**

- Describe power system models and the application of numerical methods to solve power flow problems
- Investigate power system faults, load frequency control dynamics and electromagnetic transients in power systems
- Solve economic dispatch problems using lambda iteration and unit commitment using priority list methods
- Implement state estimation using weighted least squares and contingency analysis using sensitivity factors
- Demonstrate comprehensive relay coordination and protection schemes for power systems

**LIST OF EXPERIMENTS:**

1. Computation of Transmission Line Parameters
2. Formation of Bus Admittance ( $Y_{bus}$ ) and Impedance Matrices ( $Z_{bus}$ ) and Solution of Networks
3. Power Flow Analysis using Gauss-Seidel and Newton Raphson Methods
4. Symmetrical and unsymmetrical fault analysis
5. Load – Frequency Dynamics of Single - Area Power Systems
6. Electromagnetic Transients in Power Systems: Transmission Line Energization
7. Unit commitment: Priority list method and Forward Dynamic programming
8. Economic Dispatch in Power Systems
9. State estimation: Weighted least square estimation
10. Contingency analysis using linear sensitivity factors: Generator shift factors and line outage distribution factors
11. Performance analysis of over current and impedance relay
12. Relay Coordination in Radial Feeder Protection Scheme

**TOTAL: 60 PERIODS**

  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Summarize power system performance through the application of numerical methods for power flow analysis
- Examine power system faults, load frequency dynamics, and electromagnetic transients
- Evaluate economic dispatch and unit commitment for optimal power system operation
- Apply state estimation and contingency analysis techniques for system security assessment
- Design relay coordination and protection schemes for power systems

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	–	–	2	–	–	1	3	2
CO2	3	3	2	2	2	–	–	2	–	–	1	3	2
CO3	3	3	2	2	2	–	–	2	–	–	1	3	2
CO4	3	3	3	2	2	–	–	2	–	–	1	3	2
CO5	3	3	3	2	2	–	–	2	–	–	1	3	2

  
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BoS (EEE)


**OBJECTIVES:****The students should be made to:**

- Identify real-time engineering problems suitable for project work
- Explain various methods and models relevant to the identified engineering problem
- Analyze potential solutions for the identified problem to determine the most effective approach
- Verify results and project outcomes using hardware or simulation setups to assess performance
- Develop functional project models and prepare comprehensive technical documentation

The students in a group of 3 work on a topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the head of the department and faculty members. A mini project report may be prepared and submitted to the head of the department at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report.


**TOTAL: 30 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**

- Summarize findings from an effective literature survey to establish the context for identified problems
- Implement technical ideas and methodologies to address the real-time problem
- Examine the project development process using modern tools and techniques
- Appraise the project's effectiveness and technical merit through a team presentation
- Design integrated solutions for the identified engineering problem

  
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**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	2	3	1	–	–	–	–	–	–	–	2	2	1
<b>CO2</b>	2	3	1	–	–	–	–	–	–	–	2	2	1
<b>CO3</b>	3	2	3	–	–	–	–	–	–	–	2	3	3
<b>CO4</b>	2	2	2	3	3	–	1	2	–	1	2	3	2
<b>CO5</b>	2	2	–	–	–	–	2	3	3	2	2	2	2

  
**CHAIRMAN**  
**BoS (EEE)**

**OBJECTIVES:****The students should be made to:**

- Learn the application of mathematical and project management to different contexts.
- Focus on quantitative ability and employment skills through modern practices.
- Enhance job skills and analytical ability of students
- Improve reasoning skills and employability skills
- Practice the skills on logical reasoning and interview techniques

**UNIT I INTRODUCTION TO NUMERIC ABILITY AND PROJECT MANAGEMENT 6**

Aptitude - Ratio and proportion, Partnership, Allegation or Mixtures, Coding - Decoding, Number sequence.

Soft Skills - Managerial skills - Project Cost, risk and Task management, Conflict Management and Resolution.

**UNIT II QUANTITATIVE ANALYSIS AND EMPLOYERS EXPECTATIONS 6**

Aptitude - Number system, Data Interpretation, Chain rule, Surds and Indices, Direction Sense.

Soft Skills - Employers Needs and Expectations, Mind Mapping, Situation Reaction Test (SRT).

**UNIT III ANALYTICAL SKILLS AND JOB READINESS 6**

Aptitude - Combination, Probability, Problems on Ages, Seating Arrangements.

Soft Skills - Job Application - Resume Building - Exploring and Identifying Career Options.

**UNIT IV REASONING ABILITY AND INSIGHT ON INTERVIEWS 6**

Aptitude - Menstruations, SI and CI, Cause and Effect, Statement, Assumptions and Conclusions

Soft Skills - Interview Techniques, Job Description, Roles and Responsibilities - Work Etiquettes


**UNIT V LOGICAL REASONING AND READY RECKNOERS FOR INTERVIEWS 6**

Aptitude - Input-Output Tracing – Trains – Calendar - Blood Relations.

Soft Skills - Types of Interviews, Interview Process, Analyzing the Interviewer, HR Questions & Mock Interviews.

**TOTAL: 30 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**

- Develop numerical ability and project management skills
- Achieve quantitative skills and employability skills.
- Understand both analytical and job readiness in a productive manner
- Acquire reasoning ability and interview techniques
- Obtain logical skills and interviewers' expectations

  
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**TEXT BOOKS:**

1. Aggarwal R S, “Quantitative Aptitude for Competitive Examinations”, S Chand Publishing New Delhi, Revised Edition, 2024.
2. Rajat Gupta, “Soft Skills: Tools for Success”, Yking Books, Second Edition, 2022.

**REFERENCE BOOKS:**

1. Oswaal Editorial Board, “Objective Quantitative Aptitude for All Competitive Examinations” Oswaal Books and Learning Private Limited, New Edition, 2025.
2. M. S. Rao, “Soft Skills: Enhancing Employability” I.K. International Publishing House, Revised Edition, 2025.

**USEFUL WEBLINKS:**

1. <https://learnenglish.britishcouncil.org/>
2. <https://www.english.com/>

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	1	3	2	3	1	1	1	3	2	1	2
<b>CO2</b>	2	1	1	1	1	2	2	2	2	1	2
<b>CO3</b>	2	3	2	2	2	3	2	3	3	1	2
<b>CO4</b>	2	3	2	3	3	2	1	3	2	3	2
<b>CO5</b>	1	1	2	2	3	1	2	3	3	1	2

  
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**COURSE OBJECTIVES:**

**The students should be made to:**

- Identify the fundamental components of industrial automation, measurement systems and the data acquisition process
- Design an integrated control and communication framework that utilizes specialized control structures
- Implement hardware configurations and ladder logic programming techniques for Programmable Logic Controllers
- Demonstrate the working principles of hydraulic, pneumatic and actuation systems
- Summarize the automation hierarchy, functions of SCADA, DCS and MES systems

**UNIT I INDUSTRIAL AUTOMATION FUNDAMENTALS 9**


Introduction to industrial automation – Architecture of industrial automation systems – Automation pyramid – Measurement system characteristics – Data acquisition systems – Fundamentals of automatic control systems.

**UNIT II PROCESS CONTROL STRUCTURES AND INDUSTRIAL FIELD BUSES 9**

PID Control – Controller Tuning methods – Implementation of PID Controllers – Special Control Structures: Feedforward and Ratio, Predictive, Cascade and Split–Range Control – Fieldbus networks – CAN (Controller Area Network), Basics of CAN FD, LIN and Ethernet, Device Net, Foundation Fieldbus, PROFIBUS, HART communication protocol – Introduction to industrial communication standards.

**UNIT III PROGRAMMABLE LOGIC CONTROLLERS 9**

Introduction to PLCs – Functional block diagram – Relay Ladder Logic (RLL) – PLC scan cycle – RLL Syntax and Programming – Simple and advanced ladder programs – Structured programming approach – PLC hardware architecture and programming environment.

  
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**BoS (EEE) 30/03/2024**

**UNIT IV INDUSTRIAL ACTUATION SYSTEMS 9**

Control valves for flow regulation – Hydraulic control systems – Industrial hydraulic circuits – Pneumatic control systems – Electric drives and energy savings using variable speed drives (VSDs).

**UNIT V HIGH LEVEL INDUSTRIAL AUTOMATION 9**

Automation hierarchy – Supervisory Control and Data Acquisition (SCADA) – Distributed Control Systems (DCS) – Manufacturing Execution Systems (MES) – Industrial Automation Applications in Food Processing, Aerospace, Bioprocess, Paper and Textile Industries.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the multi-level architecture of industrial automation systems and the operational principles of data acquisition
- Summarize the various process control structures and the underlying communication standards
- Execute hardware configurations and relay ladder logic programming for PLCs in various industrial scenarios
- Analyze the performance characteristics of hydraulic circuits, pneumatic systems, and variable speed drives
- Evaluate the implementation of SCADA and DCS in environments such as food processing, aerospace, and textile industries

**TEXT BOOKS:**

1. Mukhopadhyay S, Sen S and Deb A K, “Industrial Instrumentation, Control and Automation”, First Edition, Jaico Publishing House, 2013.
2. George Stephanopoulos, “Chemical Process Control, An Introduction to Theory and Practice”, First Edition, Pearson Education India, 2015.

**REFERENCES:**

1. Dr Moustafa Elshafei, “Modern Distributed Control Systems”, Create Space Independent Publishing Platform, First Edition, 2016.

  
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**BoS (EEE)**

2. Krishna Kanth, "Computer based Industrial Control" Prentice Hall of India, Second Edition, 2014.
3. Herbert E Merritt, "Hydraulic Control Systems", Wiley, 1991.
4. Krishnan R, "Electric Motor Drives, Modelling, Analysis and Control", Prentice Hall India, 2002.

**Mapping of COs with POs and PSOs:**

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<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	2	2	1
<b>CO3</b>	3	2	3	1	2	-	-	-	-	-	2	2	1
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	2	2	1
<b>CO5</b>	3	3	3	2	2	-	-	-	-	-	2	2	2

*P. S. Prasad*  
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**BoS (EEE)** 30/03/2026

24ME705PE

**TOTAL QUALITY MANAGEMENT**  
(COMMON TO AGE, BME, ECE, EEE, CIVIL AND MECH)

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**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Learn the fundamental approaches and philosophy of Total Quality Management (TQM)
- Know the core concepts and principles of TQM
- Equip with knowledge of both traditional and modern quality improvement tools
- Understand the different types of TQM techniques across different industries
- Study the various quality systems, international standards, and procedural frameworks

**UNIT I INTRODUCTION**

**9**

Definition of quality and TQM – basic needs of TQM – contributions of Deming, Juran, Crosby – TQM framework – history review of quality management – dimensions of quality – barriers to TQM – benefits of TQM – quality council – quality statements.

**UNIT II TQM PRINCIPLES**

**9**

Customer satisfaction – customer perception of quality, customer complaints, service quality, Kano Model and customer retention – employee involvement – motivation, empowerment, team and teamwork, recognition and reward, performance appraisal – continuous process improvement – PDSA cycle, 5s and Kaizen – supplier partnership– supplier selection and supplier rating and relationship development.

**UNIT III TQM TOOLS**

**9**

Basic seven tools of quality – new seven management tools – six-sigma – concepts and process – quality costs – BPR - reengineering process – improvement strategies – Taguchi principles – quality loss function – role of IT in TQM.

**UNIT IV TQM TECHNIQUES**

**9**

Benchmarking – reasons, types and process – Failure Mode of Effect Analysis (FMEA) – procedures and types – Quality Function Deployment (QFD) – benefits and process – Total Productive Maintenance (TPM) – process.

**UNIT V QUALITY SYSTEMS**

**9**

Benefits of ISO registration – ISO 9000 series of standards – ISO 9000 requirements and implementation – other sectors specific standards – documentation – audit – ISO 14000 series of standards – concepts, requirements and benefits – quality awards.

**TOTAL: 45 PERIODS**

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(BoS / MECH)

28/10/20

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the basic approaches and philosophy of TQM in organizational contexts.
- Interpret the key principles and concepts of Total Quality Management.
- Apply basic and advanced quality tools for process improvement and problem-solving.
- Identify the use of TQM techniques in real-world industrial scenarios.
- Build standardized quality systems and procedures to ensure improved quality assurance

**TEXT BOOKS:**

1. Dale H Besterfield, "Total Quality Management", Pearson Education Asia, 5<sup>th</sup> Edition, 2018.
2. Poonia M P and Sharma S C, "Total Quality Management", Khanna Publication, 1<sup>st</sup> Edition 2019

**REFERENCES:**

1. James R Evans and William M Lindsay, "The Management and Control of Quality", South-Western Cengage Learning, 11<sup>th</sup> Edition, 2020.
2. Vijayan V and Ramakrishnan H "Total Quality Management", S Chand Publication, Pune, 1<sup>st</sup> Edition, 2014.
3. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 7<sup>th</sup> Edition, 2011.
4. Poornima M Charantimath, "Total Quality Management", Pearson Education, 4<sup>th</sup> Edition, 2022.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	2	2	-
CO2	2	2	-	-	-	-	-	-	2	2	-
CO3	3	2	-	-	2	-	-	-	2	2	-
CO4	3	2	-	-	2	-	-	-	2	2	-
CO5	3	2	-	-	2	-	-	-	2	2	-

  
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**OBJECTIVES:****The students should be made to:**

- Describe the types and importance of conventional and renewable energy resources
- Explain the fundamentals of solar energy and its applications
- Assess the role of wind energy in power generation
- Analyze methods of electricity generation through geothermal, biomass and hybrid energy systems
- Examine the process involved in extraction of other energy sources and their conversion mechanisms

**UNIT I INTRODUCTION TO RENEWABLE ENERGY SYSTEMS 9**

Electrical energy from conventional sources – Energy reserves and power scenario in India – Types of renewable energy sources – Importance of renewable energy – Sustainable design and development – Environmental impacts of renewable energy generation – Hydroelectric projects – Global warming potential – Emerging renewable technologies – Distributed energy systems and Dispersed generation – National tariff policy.

**UNIT II SOLAR ENERGY 9**

Solar radiation – Solar geometry, estimation and measurement – Flat plate collector – Types of concentrating solar collectors – Solar thermal energy storage – Solar ponds – Solar water heaters and air heaters – Solar cookers – Solar air conditioning and refrigeration – Solar greenhouse systems – Solar thermal power plants – Photovoltaic effect – Semiconductor materials for solar cells – Applications of PV systems – Grid-connected solar photovoltaic systems – Grid integration issues.

**UNIT III WIND ENERGY 9**

Classification of wind turbines and rotor types – Aerodynamic operation of wind turbines – Wind characteristics and energy extraction – Variation of wind speed with elevation – Site selection and land requirements for wind farms – Design of wind turbine rotor – Horizontal-axis wind turbine generators – Modes of wind power generation – Estimation of wind energy potential – Wind resource assessment in India – Grid interfacing techniques and methods of grid connection – Grid system and properties.

**UNIT IV GEOTHERMAL, BIOMASS AND HYBRID ENERGY SYSTEMS 9**

Geothermal energy resources power generation – Biomass energy resources – Biomass conversion technologies – Biochemical conversion process – Biomass gasification – Biogas – Types of Biogas plants – Energy recovery from urban waste – Power generation from liquid waste – Biomass cogeneration – Biodiesel and bioethanol – Need for hybrid energy systems –Types of hybrid systems.

**UNIT V OTHER ENERGY SOURCES 9**

Tidal Energy – Tidal characteristics – Types of tidal power plants – Important components of tidal power plants.

Wave Energy: Factors affecting the wave energy – Wave energy conversion systems.

Ocean Thermal Energy Conversion (OTEC): Working principle – Open–cycle and closed–cycle OTEC systems.

Chemical energy sources: Hydrogen production – Hydrogen storage – Application of hydrogen in industry – Fuel cells: Principle and types.

**TOTAL: 45 PERIODS**


**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the various renewable energy resources and its environmental impacts
- Apply the working principle of various solar energy systems
- Analyze the components and techniques involved in wind energy conversion systems
- Design biomass, geothermal and hybrid energy systems for sustainable power generation
- Evaluate various alternative energy sources, their types and applications

**TEXT BOOK:**

1. Kothari P, Singal K C and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, Third Edition, Printice Hall of India Private Limited, New Delhi, 2024.

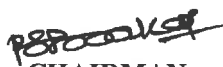
  
**CHAIRMAN**  
**BoS (EEE)**

## REFERENCES:

1. Rai G D, "Non-Conventional Sources of Energy Sources", Khanna Publishers, New Delhi, 2017.
2. Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Third Edition, Oxford University Press, U.K, 2012.
3. Twidell J W and Weir A, "Renewable Energy Sources", Third Edition, EFN Spon Limited, UK, 2015.
4. Tiwari G N, "Solar Energy - Fundamentals Design, Modelling and Applications", Revised Edition, Narosa Publishing House, New Delhi, 2012.
5. Gilbert M Master, "Renewables and Efficient Electric Power Systems", Second Edition, John Wiley and Sons, 2013.

## Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	–	–	–	–	2
CO2	3	3	3	2	–	–	–	–	–	–	2
CO3	3	3	2	2	–	–	–	–	–	–	2
CO4	3	3	3	1	–	–	–	–	–	–	2
CO5	3	3	2	2	–	–	–	–	–	–	3

  
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**COURSE OBJECTIVES:****The students should be made to:**

- Identify PLC field devices and interface modules
- Construct ladder logic programs to perform logic gate functions, arithmetic operations, and subroutine-based control tasks in PLC systems
- Design PLC-based sequential control systems and DC motor operation schemes for industrial applications
- Analyze PLC systems with SCADA and HMI platforms to enable real-time monitoring and supervisory control
- Investigate PLC–VFD integrated systems to achieve effective direction and speed control of induction motors

**LIST OF EXPERIMENTS:**

1. Identification of PLC field device interface modules (AI, AO, DI and DO modules)
2. Programming Logic Gates Function in PLC
3. Implementing Mathematical Operations in PLC
4. Programming Jump-to-subroutine and return operations in PLC
5. PLC based Traffic Light Control Operation
6. PLC based Tank Filling/Draining Control Operation
7. PLC based Door Open and Close System
8. PLC based Reversal of DC Motor Direction
9. Monitoring of physical parameters via PLC using SCADA
10. HMI Based DC Motor Forward and Reverse Direction Control Using PLC
11. Direction control of three phase induction drive by Integration of PLC and VFD
12. Speed control of induction motor by using Variable Frequency Drive

**TOTAL: 45 PERIODS**

  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain PLC field devices and interface modules
- Develop PLC programs for logic gates, mathematical operations and subroutines
- Create PLC-based sequential and DC motor control applications
- Integrate PLC with SCADA and HMI for monitoring and control
- Construct PLC–VFD based direction and speed control of induction motor

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	1	–	–	–	–	2	–	–	1	1	1
<b>CO2</b>	3	2	2	2	2	–	–	2	–	–	1	2	1
<b>CO3</b>	3	3	3	2	2	–	–	2	–	–	1	2	1
<b>CO4</b>	3	2	3	2	2	–	–	2	–	–	1	2	2
<b>CO5</b>	3	3	3	2	2	–	–	2	–	–	1	3	2

  
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**COURSE OBJECTIVES:**


**The students should be made to,**

- Analyze the performance characteristics of solar PV systems
- Execute the operation of wind energy systems and micro wind generators
- Investigate the working of standalone renewable energy systems
- Evaluate the performance of hybrid renewable energy systems
- Formulate models for the working of hydel power plants and fuel cell systems

**LIST OF EXPERIMENTS:**

1. Simulation of solar PV energy system.
2. Experiment on V-I and P-V characteristics and efficiency of solar PV system.
3. Experiment on performance assessment of grid connected (On-grid) and standalone (Off-grid) solar PV system.
4. Simulation of V-I characteristics of a PV module with partial shading.
5. Experiment on shadowing effect and diode-based solution in solar PV system.
6. Simulation of wind energy generator.
7. Experiment on performance assessment of micro wind energy generator.
8. Simulation of hybrid power system.
9. Experiment on performance assessment of hybrid power system.
10. Simulation of Off Grid Solar PV battery system.
11. Simulation of hydel power system.
12. Experiment on performance assessment of fuel cell.
13. Design and simulation of fuel cell.

**TOTAL: 45 PERIODS**

  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Examine the characteristics of Solar PV systems under normal and partial shading conditions
- Demonstrate the operating characteristics of wind energy systems and micro wind generators
- Compare the performance of standalone renewable energy systems
- Design hybrid renewable energy systems using simulation tools
- Assess the operational performance of hydel power plants and fuel cell systems

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	–	–	2	–	–	1	3	2
CO2	3	2	2	2	2	–	–	2	–	–	1	3	2
CO3	3	3	2	2	2	–	–	2	–	–	1	3	2
CO4	3	3	2	2	2	–	–	2	–	–	1	3	2
CO5	3	3	2	2	2	–	–	2	–	–	1	3	2

  
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**OBJECTIVES:****The students should be made to:**

- Investigate research literature to identify relevant engineering problems
- Formulate solutions by integrating modern engineering tools
- Apply methodologies experimentally and assess results
- Communicate project work effectively through documentation and oral presentation
- Develop research manuscripts for conference/journal publication adhering to ethical standards.

The students in a group of not more than 3 work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on minimum of three reviews. There shall be a minimum of three members in the review committee. The guide will be an additional member of the Review Committee and he/ she should be present during the presentation of his/her group. A project report may be prepared and submitted to the head of the department at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the head of the department.

**TOTAL: 300 PERIODS****OUTCOMES:****On successful completion of this course, the students will be able to,**


- Analyze literature survey to define a relevant engineering problem
- Design solutions using modern tools, techniques and processes to address identified problems
- Implement methodologies for product development and result validation addressing societal needs.
- Demonstrate effective communication through project documentation and oral presentation

  
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- Apply research ethics and standardized formats to publish project work in conference proceedings or journals

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	1	1	–	–	–	–	–	–	–	3	2
<b>CO2</b>	2	2	3	1	2	–	–	2	–	–	–	3	2
<b>CO3</b>	2	2	2	3	2	–	–	1	–	2	–	3	2
<b>CO4</b>	–	–	–	–	–	–	–	3	3	–	–	3	2
<b>CO5</b>	–	–	–	–	–	2	2	–	1	–	3	3	2

  
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**COURSE OBJECTIVES:**

The students should be made to:

- Understand the principles and trends of EHVAC transmission
- Investigate electrostatic fields, voltage gradients and their effects
- Explore power control methods and compensation techniques
- Examine corona effects, audio noise and radio interference
- Analyze steady-state and transient limits, as well as six-phase and Ultra High Voltage (UHV) systems

**UNIT I INTRODUCTION 9**

EHVAC Transmission line trends and preliminary aspect – Standard transmission voltages – Estimation at line and ground parameters – Bundle conductors: Properties – Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line parameters for modes of propagation.

**UNIT II ELECTROSTATIC FIELDS 9**

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings – Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

**UNIT III POWER CONTROL 9**

Electrostatic induction in unenergized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Unenergized lines. Power frequency voltage control and overvoltage in EHV lines – No load voltage – Charging currents at power frequency – Voltage control – Shunt and Series compensation – Static VAR compensation.

**UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9**

Corona in EHV lines – Corona loss formulae – Charge voltage diagram – Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits – Measurements of audio noise radio interference due to Corona – Properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

**UNIT V STEADY STATE AND TRANSIENT LIMITS 9**

Design of EHV lines based on steady state and transient limits – EHV capabilities and their characteristics – Introduction six phase transmission – UHV.

**TOTAL: 45 PERIODS**

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### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the parameters of EHVAC transmission lines and their propagation modes
- Analyze electrostatic fields around EHV lines and assess their impacts
- Apply voltage control and compensation methods in EHVAC transmission lines
- Evaluate corona effects, losses and electromagnetic interference due to corona
- Assess steady-state and transient performance limits of EHVAC systems

### TEXT BOOK:

1. Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International Publishers, New Delhi, 2012.

### REFERENCES:

1. Rao S, "HVAC and HVDC Transmission, Engineering and Practice" Khanna Publisher, Delhi, 1990.
2. Subir Ray, "An Introduction to High Voltage Engineering", Second Edition, Prentice Hall of India Private Limited, 2013.
3. Begamudre R D, "Extra High Voltage AC Transmission Engineering", Fourth Edition, New Academic Science Limited, 2011.
4. Arun G Phadke and James S Thorp, "Computer Relaying for Power Systems", Wiley, 2009.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	-	-	-	-	-	-	2	3	3

  
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**COURSE OBJECTIVES:**

The students should be made to:

- Understand factors that influence power system security
- Learn state estimation processes in power systems
- Detect network problems and understand network equivalents
- Explore security constrained optimization techniques
- Analyze case studies on power system security

**UNIT I BASICS OF POWER SYSTEM SECURITY 9**

Factors affecting power system security – Decomposition and multilevel approach – State estimation – System monitoring using SCADA – Security assessment and security enhancement.

**UNIT II POWER SYSTEM STATE ESTIMATION 9**

Maximum likelihood weighted least-square estimation – State estimation – Detection and identification of bad measurements – Estimation of quantities – Network observability and pseudo measurements.

**UNIT III SECURITY ASSESSMENT 9**

Detection of network problems – Network equivalent for external system – Network sensitivity methods – Calculation of network sensitivity factors – Fast contingency algorithms – Contingency ranking – Dynamic security indices – PMU based voltage security assessment.

**UNIT IV SECURITY ENHANCEMENT 9**

Correcting the generator dispatch by sensitivity methods – Compensated factors – Security constrained optimization – Preventive – Emergency and restorative control through NLP and LP methods.

**UNIT V SECURITY TECHNIQUES 9**

Voltage security assessment – Transient security assessment methods – Comparison – Case study: Power system security assessment using neural networks and machine learning techniques – SCADA.

**TOTAL: 45 PERIODS**

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### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify the key factors affecting power system security
- Perform state estimation using appropriate techniques
- Calculate sensitivity factors and apply contingency analysis
- Design control strategies for different security scenarios
- Evaluate case studies to understand practical security challenges in power systems

### TEXT BOOK:

1. Venkatesh P, Manikandan B V, Charles Raja S and Srinivasan A, "Electrical Power Systems: Analysis, Security and Deregulation", Second Edition, PHI Learning Private Limited, 2017.

### REFERENCES:

1. Leonard L Grigsby, "Power System Stability and Control", Third Edition, CRC Press, 2012.
2. Samir Ibrahim Abood, "Philosophy of Power System Protection and Security: Computer Aided Design and Analysis", Nova Science Publishers Inc, 2021.
3. Allen J Wood, Bruce F Wollenberg and Gerald B Sheble, "Power Generation, Operation and Control", Third Edition, John Wiley and Sons, 2013.
4. Kothari D P and Nagrath I J, "Power System Engineering", Third Edition, Tata McGraw-Hill Education, 2019.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	2	3	2
CO2	3	2	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO4	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	-	-	-	-	-	-	2	3	3

  
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BoS (EEE)

**COURSE OBJECTIVES:****The students should be made to:**

- Understand the reasons and process of power sector restructuring
- Explore the methods for managing transmission congestion in deregulated power markets
- Examine the congestion management and transmission pricing methods
- Explore locational marginal pricing, FTRs and ancillary services
- Evaluate global and Indian electricity market reforms

**UNIT I INTRODUCTION**

9

Reasons for restructuring – Understanding the restructuring process – Objectives of deregulation of various power systems across the world – Consumer behavior – Supplier behavior – Market equilibrium – Short-run and Long-run costs – Various costs of production. The Philosophy of market models: Market models based on contractual arrangements – Market architecture

**UNIT II TRANSMISSION CONGESTION MANAGEMENT**

9

Importance of congestion management in deregulated environment – Classification of congestion management methods – Calculation of ATC – Non-market methods – Market based methods – Nodal pricing – Inter-zonal, Intra-zonal congestion management – Price area congestion management – Capacity alleviation method.

**UNIT III LOCATIONAL MARGINAL PRICES(LMP) AND FINANCIAL TRANSMISSION RIGHTS**

9

Fundamentals of locational marginal pricing – Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Risk hedging functionality of financial transmission rights – FTR issuance process – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power.

**UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK**

9

Types of ancillary services – Load-generation balancing related services – Voltage control and reactive power support services – Black start capability service – Mandatory provision of ancillary services – Markets for ancillary services – Co-optimization of energy and reserve services – International comparison. Pricing of transmission network: Wheeling – principles of transmission pricing – transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Loss allocation methods.

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**UNIT V MARKET EVOLUTION**

9

US markets: PJM market – The Nordic power market – Reforms in Indian power sector: Framework of Indian power sector – Reform initiatives – Availability Based Tariff (ABT) – The Electricity act 2012 – Open access issues – Power exchange.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the reasons and process involved in power sector restructuring
- Apply methods to manage transmission congestion in deregulated power markets
- Analyze various congestion management and transmission pricing techniques
- Calculate locational marginal prices, explain financial transmission rights and describe ancillary services
- Compare international electricity markets and assess reforms in the Indian power sector

**TEXT BOOKS:**

1. Mohammad Shahidehpour, Muwaffaq Alomoush, “Restructured Electrical Power Systems: Operation, Trading and Volatility”, First Edition, Marcel Dekker Publications, 2001.
2. Kankar Bhattacharya, MathH J Boolean, and Jaap E Daadler, “Operation of Restructured Power Systems”, First Edition, Kluwer Academic Publications, 2001.

**REFERENCES:**

1. Paranjothi, S.R., “Modern Power Systems The Economics of Restructuring”, First Edition, New Age International Publishers, 2017.
2. Sally Hunt, “Making Competition Work in Electricity”, John Willey and Sons Inc. 2002.
3. Steven Stoff, “Power System Economics: Designing Markets for Electricity”, Wiley-IEEE Press, 2002.
4. Allen J Wood and Bruce F Wollen berg, “Power Generation, Operation and Control”, Third Edition, John Wiley and Sons Inc, 2016.
5. Khaparde S A and Abhyankar A R, “Restructured Power Systems”, NPTEL Course, <https://nptel.ac.in/courses/108101005/>.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	2
CO3	3	3	2	3	–	–	–	–	–	–	2	3	2
CO4	3	3	2	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

*PSPBOOKS*  
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**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to,

- Learn the evolution, configuration and components of HVAC and HVDC systems
- Understand the operation of single-phase and three-phase converters in HVDC systems
- Impart knowledge on constant current and constant voltage control techniques
- Identify converter misoperation, harmonics and mitigation methods
- Examine protection and fault management in HVDC systems

**UNIT I INTRODUCTION TO HVDC SYSTEMS 9**

Historical development of HVAC and HVDC system. HVDC system configuration and components comparison – Economic technical performance – Reliability: Energy availability and Transient reliability – Limitations.

**UNIT II CONVERTER CIRCUITS AND ANALYSIS 9**

Introduction to single phase and three phase converters. Converters for HVDC system – 6 pulse converter and 12 pulse converter (both LCC and VSC types). Analysis of 6 pulse converter with and without source impedance – With overlap less than 60 degrees – With overlap greater than 60 degrees – Complete characteristics of HVDC converter – Rectifier mode and Inverter mode of operation – Equivalent circuits.

**UNIT III HVDC CONTROL TECHNIQUES 9**

Basic means of control – Power reversal – Constant current versus constant voltage control characteristics – Desired features of control. Ideal and actual steady state characteristics – Combined rectifier and inverter characteristics – Constant minimum delay angle control, constant current control, constant extinction angle control and tap changer control.

**UNIT IV MISOPERATION OF CONVERTERS AND HARMONICS 9**

Introduction to converter disturbance – Causes and effects – By pass action in bridges – Commutation failure. Characteristic and un-characteristic harmonics – Troubles due to harmonics – Means of reducing harmonics.

**UNIT V HVDC PROTECTION AND MULTI-TERMINAL SYSTEMS 9**

Basics of protection – DC reactors – Voltage and current oscillations – Clearing line faults and re-energising – Circuit breakers – Over voltage protection – Control of di/dt and dv/dt – Introduction to multi terminal HVDC system.

**TOTAL: 45 PERIODS**

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 BoS (EEE) 16/10/25

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the development and structure of HVAC and HVDC transmission systems
- Describe the working principles of 6-pulse and 12-pulse converters
- Apply control techniques for current and voltage regulation in HVDC systems
- Analyze converter faults and harmonics with reduction methods
- Evaluate protection schemes for HVDC systems with multi-terminal networks

**TEXT BOOK:**


1. Padiyar K R, "HVDC Transmission Systems", Third Edition, New Age International Publishers Limited, New Delhi, 2017.

**REFERENCES:**

1. Arrillaga J, "High voltage Direct Current Transmission", Second Edition, IEEE Publications, 2012.
2. Kamakshiah S and Kamaraju V, "HVDC Transmission", Second Edition, McGraw-Hill, New Delhi, 2020.
3. Singh S N, "Electric Power Generation, Transmission and Distribution", Second Edition, Printice Hall of India, 2008.
4. Kimbark E W, "Direct Current Transmission", Second Edition, John Wiley and Sons, 2006.
5. Hingorani N G and Guygi L, "Understanding FACTS", First edition, IEEE Press, USA, 2001.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	2
CO3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO4	3	3	2	3	–	–	–	–	–	–	2	3	2
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

  
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**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to,

- Understand the causes and characteristics of over voltages including lightning and switching surges
- Compare different breakdown mechanisms in gaseous, liquid, solid and vacuum dielectrics
- Explore the methods for generating high voltages and currents for various electrical applications
- Apply measurement techniques for high voltages and currents
- Conduct high voltage tests on power system equipment and explore electrostatic applications

**UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9**

Introduction to over voltages – Nature causes of over voltages – Charge formation in the clouds – Lightning phenomenon – Mechanism of lightning stroke, Lightning, Switching surges and temporary over voltages – Reflection and Refraction of travelling waves – Protection against over voltages – Insulation coordination.

**UNIT II ELECTRICAL BREAKDOWN MECHANISM IN DIELECTRICS 9**

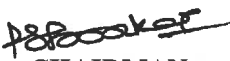
Gaseous breakdown – Uniform and non-uniform fields – Corona discharges – Townsend criterion – Streamer theory – Pachen's Law – Vacuum breakdown – Conduction, breakdown in pure and commercial liquids and its properties – Breakdown mechanisms in solid and composite dielectrics – Applications of insulating materials in electrical equipment.

**UNIT III GENERATION OF HIGH VOLTAGES AND CURRENTS 9**

Generation of high DC voltage: Multiplier circuits, vande-graff generator – Generation of high AC voltages: cascaded transformers, resonant transformer and Tesla coil – Analysis of DC/AC and Impulse generator circuits – Tripping and control of impulse generators.

**UNIT IV MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 9**

Measurement of high DC voltages. Measurement of high AC voltages: Power frequency, High frequency and impulse voltages – Electrostatic voltmeters – Measurement of high DC currents – Measurement of high AC currents power frequency, High frequency and impulse currents – Generating voltmeters – Capacitance Voltage Transformers (CVT) – Digital techniques in high voltage measurement.

  
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**UNIT V HIGH VOLTAGE TESTING AND APPLICATION IN INDUSTRY 9**

High voltage testing methodologies: Insulators, Bushing, Isolators, Circuit breakers, Cables, Transformers and Surge arrester. Electrostatic applications – Electrostatic precipitation, separation, painting /coating, spraying, imaging, printing and Biomedical applications.

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Demonstrate methods to protect power systems from over voltages
- Analyze breakdown processes in gases, liquids, solids and vacuum dielectrics
- Design high voltage DC, AC and impulse generators
- Demonstrate the measurement of high voltages and currents using various techniques
- Evaluate high voltage testing methodologies and their industrial applications

**TEXT BOOKS:**


1. Naidu M S and Kamaraju V, “High Voltage Engineering”, Eleventh Reprint, Tata McGraw Hill, 2022.
2. Wadhwa C L, “High voltage Engineering”, Fourth Edition, New Age International Private Limited, 2020.

**REFERENCES:**

1. Kuffel E and Zaengl W S, “High Voltage Engineering Fundamentals”, Pergamon press, Oxford, London, 2000.
2. Ravindra Arora and wolfgang Mosch, “High Voltage Insulation Engineering”, New Age International Publishers, Reprint, 2013.
3. Alston L L, “High Voltage Technology”, Oxford University Press, Oxford, 2006.
4. Subir Ray, “An Introduction to High Voltage Engineering”, Second Edition, PHI Learning Private Limited, New Delhi, 2011.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	2	–	2	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	2	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	3	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	2	–	2	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	3	–	3	–	–	–	–	2	3	3

  
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**COURSE OBJECTIVES:**

The students should be made to:

- Describe the need for substations and outline the budgeting, financing, and design process including site selection and commissioning
- Elucidate various high voltage switching devices and their operation under different ambient conditions
- Classify different types of substations and explain common bus and switching configurations
- Design effective grounding systems for substations considering safety and soil characteristics
- Explain components and applications of substation automation systems and SCADA communications

**UNIT I INTRODUCTION**

9

Background – Need – Determination – Budgeting – Financing – Traditional and innovative substation design – Site selection and acquisition – Design, construction and commissioning process.

**UNIT II HIGH VOLTAGE SWITCHING EQUIPMENT**

9

Ambient conditions – Disconnect switches – Load break switches – High speed grounding switches – Power fuses – Circuit switches – Circuit breakers.

**UNIT III TYPES OF SUBSTATIONS AND BUS/SWITCHING CONFIGURATIONS**

9

Transmission substation – Distribution substation – Collector substation – Switching substations – gas insulated substations – Air insulated substations – Bus configurations: Single bus, double bus, double break, main and transfer bus, double bus, single breaker, ring bus – Break-and-a-half – Comparison of configurations.

**UNIT IV DESIGN OF SUBSTATION GROUNDING AND PROTECTION**

9

Reasons for substation grounding system – Accidental ground circuit – Design criteria – Actual touch and step voltage – Soil resistivity – Grid resistance – Grid current – Use of the design equations – Selection of conductors – Grounding fence – Other design considerations. Lightning stroke protection – Lightning parameters – Empirical design methods. Substation fire protection – Fire hazards, Fire protection measures and fire protection selection criterion.

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**UNIT V SUBSTATION AUTOMATION AND COMMUNICATIONS 9**

Introduction, components of substation automation system – Automation applications – protocol fundamentals – Supervisory Control And Data Acquisition (SCADA) historical perspective, SCADA functional requirements, SCADA communication requirements, components of SCADA system, SCADA communication protocols, the structure of a SCADA communication protocol – Security for substation communications, security methods, security assessment.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Demonstrate plan and organize substation design and construction activities effectively
- Identify the functions of disconnect switches, load break switches, grounding switches, fuses and circuit breakers
- Analyze substation types and bus arrangements to select suitable configurations
- Calculate grounding parameters and protection measures against lightning and fire hazards
- Evaluate SCADA protocols, security measures for substation communication networks

**TEXT BOOK:**

1. John D McDonald, “Electrical Power Substation Engineering”, Third Edition, CRC Press, 2017.

**REFERENCES:**

1. Dahiya R S and Vinay Attri, “Sub-Station Engineering Design and Computer Applications”, First Edition, S K Kataria and Sons Publications, 2013.
2. Satnam P S, Gupta P V, “Substation Design and Equipment”, First Edition, Dhanpat Rai Publications, 2013.
3. Turan Gonen, “Electric Power Distribution Engineering” Third Edition, CRC press, 2014.
4. “Design guide for rural substation”, United States Department of Agriculture, RUS Bulletin, 1724E-300, June 2001.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	2	–	2	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	3	–	2	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	3	–	2	–	–	–	–	2	3	3

  
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**BoS (EEE)**

<b>24EE107PE</b>	<b>SMART GRID: BASICS TO ADVANCED TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**The students should be made to:**

- Describe the parts and technology of a smart grid system
- Learn about different energy storage devices and how to place them in the grid
- Analyze the different protection schemes involved in the micro grid system
- Examine the wind, solar energy system based smart grids
- Compare the different analysis of energy management system

**UNIT I INTRODUCTION** **9**  
 Smart Grid – Architecture of Smart Grid system – Standards for Smart Grid system – Elements and Technologies of Smart Grid system – Distributed Generation resources.

**UNIT II ENERGY STORAGE AND MONITORING** **9**  
 Basics of energy storage devices – Types – Analytical modelling – Optimal sizing and siting of storages– Battery Management System (BMS) – Wide area monitoring systems – Phasor estimation – Modelling of storage devices.

**UNIT III PROTECTION AND CONTROL** **9**  
 Digital Relays for Smart Grid protection – Islanding detection techniques – Smart Grid protection – Modelling of DC smart grid components – Operation and control of AC Microgrid – Operation and control of AC–DC hybrid Microgrid – Cyber security and resiliency – Virtual inertia and ancillary support.

**UNIT IV DEMONSTRATION AND CASE STUDY** **9**  
 Demonstration of solar power generation – Demonstration of wind power generation – Demonstration of Battery Management System – Demonstration of EV charging system – Simulation and case study of AC Microgrid, DC Microgrid and AC–DC Hybrid microgrid.

**UNIT V ANALYSIS AND ENERGY MANAGEMENT** **9**  
 Demonstration of energy management in microgrid – Demonstration of PHIL experimentation for symmetric and asymmetric fault analysis of grid-connected DFIG wind turbine – System analysis of AC/DC Smart Grid – Demonstration on peak energy management using energy storage system.

**TOTAL: 45 PERIOD**

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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the main elements and standards of a smart grid
- Categorize and monitor the different energy storage devices in micro grids
- Inspect the different protection schemes involved in the micro grid system
- Construct the wind, solar energy system based smart grids
- Design the different analysis of energy management system

**TEXT BOOKS:**

1. A Keyhani and M Marwali, “Smart Power Grids”, Springer, 2011.
2. Nikos Hatziargyriou, “Microgrids: Architectures and Control”, Wiley-IEEE Press, 2014.

**REFERENCES:**

1. Arun Phadke, “Computer Relaying for Power Systems”, Second Edition, Wiley India Private Limited, 2012.
2. Fang Lin Luo, Hong Ye, “Renewable Energy Systems: Advanced Conversion Technologies and Applications”, First Edition, CRC Press Inc, 2012.
3. Amirnaser Yazdani and Reza Iravani, “Voltage-Sourced Converters in Power Systems Modeling, Control and Applications”, First Edition, Wiley-IEEE Press, 2010.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	2	–	2	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	2	–	2	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	3	–	2	–	–	–	–	2	3	3

  
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**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Introduce fundamental concepts, definitions and standards related to power quality
- Analyze voltage sags, interruptions and their mitigation methods
- Examine sources, effects, and protection strategies for transient over-voltages
- Understand harmonic generation, measurement and mitigation
- Evaluate the impact of distributed generation on power quality

**UNIT I INTRODUCTION 9**

Terms and definitions – Transients – Long–Duration voltage variations – Short–duration voltage variations – Voltage imbalance – Waveform distortion – Voltage fluctuation – Power frequency variations – Power quality terms – Ambiguous terms – CBEMA and ITI curves.

**UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9**

Sources of sags and interruptions – Estimating voltage sag performance – Fundamental principles of protection – Solutions at the end–user level – Motor–Generator sets, Flywheel energy storage systems and Superconducting Magnetic Energy Storage Device (SMES) – Motor starting sags – Utility system fault–clearing issues.

**UNIT III TRANSIENT OVERVOLTAGES 9**

Sources of transient over–voltages – Principles of overvoltage protection – Devices for overvoltage protection – Utility capacitor–switching transients – Utility system lightning protection – Managing ferro–resonance – Switching transient problems with loads – Computer tools for transients analysis.

**UNIT IV FUNDAMENTALS OF HARMONICS 9**

Harmonic distortion – Voltage versus current distortion – Harmonics versus transients – Harmonic indexes – Harmonic sources from commercial loads – Harmonic sources from industrial loads – Locating harmonic sources – System response characteristics.

**UNIT V DISTRIBUTED GENERATION AND POWER QUALITY 9**

Resurgence of DG – DG technologies – Interface to the utility system – Power quality issues – Operating conflicts – DG on distribution networks – Sizing and siting of DG – Interconnection standards.

**TOTAL: 45 PERIODS**

*P.P. Prasad*  
CHAIRMAN  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the key power quality terms, definitions and standards
- Analyze voltage sags and interruptions, identify sources and propose suitable mitigation techniques
- Identify sources of transient over-voltages, assess their effects and describe protection strategies
- Evaluate harmonic sources, measure harmonic distortion and suggest effective mitigation methods
- Assess the power quality impacts of distributed generation

**TEXT BOOK:**

1. Roger C Dugan, Mark F McGranaghan, Surya Santoso and Wayne Beaty H, "Electrical Power Systems Quality", McGraw Hill, 2017.

**REFERENCES:**

1. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad, "Power Quality: Problems and Mitigation Techniques", John Wiley and Sons, 2015
2. Arrillaga J, Watson N R and Chen S, "Power System Quality Assessment", Wiley, New York, 2011.
3. Bollen M-H J, "Understanding Power Quality Problems: Voltage Sags and Interruptions", New York, IEEE Press, 2011.
4. Arindam Ghosh, "Power Quality Enhancement Using Custom Power Devices", Springer International Edition, 2002.
5. Sankaran C, "Power Quality", CRC Press, 2002.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	2	-	-	-	-	-	-	2	3	2
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	2	3	2
<b>CO3</b>	3	3	2	2	-	-	-	-	-	-	2	3	2
<b>CO4</b>	3	3	2	1	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	1	-	-	-	-	-	-	2	3	2

*P. S. Sankaran*  
 CHAIRMAN  
 BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the basic concepts and different topologies of multilevel converters
- Learn the structure, operation and modulation strategies of CAMC
- Analyze the diode-clamped multilevel converter (DCMC) topology
- Know the flying capacitor multilevel converter (FCMC), its modulation schemes and voltage balancing techniques
- Access Flexible AC Transmission Systems (FACTS) devices, their principles and applications in power flow control and system stability

**UNIT I MULTILEVEL TOPOLOGIES 9**

Introduction – Generalized topology with a common DC bus – Converters derived from the generalized topology – Symmetric topology without a common DC link – Asymmetric topology – Emerging configurations – Hybrid multilevel converters – Modular topologies.

**UNIT II CASCADE ASYMMETRIC MULTILEVEL CONVERTER 9**

Introduction – General characteristics of the Cascade Asymmetric Multilevel Converter (CAMC) – Modulation strategy – Averaged voltage – CAMC three-phase inverter – Averaged currents in the DC bus –  $i_{dc}$  Current – Common mode and differential mode currents – Common mode current – Differential mode harmonic currents – Comparison of the five-level topologies – Diode-Clamped Multilevel Converter (DCMC) – Flying Capacitor Multilevel Converter (FCMC) – Cascaded Asymmetric Multilevel Converter (CCMC) – Cascaded Asymmetric Multilevel Converter (CAMC).

**UNIT III DIODE CLAMPED MULTILEVEL CONVERTER (DCMC) 9**

Introduction – Converter structure and functional description – Advantages and limitations of diode-clamped topology – Modulation of multilevel converters – Voltage balance control – Effectiveness boundary of voltage balancing in DCMC converters – Performance results.

**UNIT IV FLYING CAPACITOR MULTILEVEL CONVERTER (FCMC) 9**

Introduction – Flying capacitor topology – Modulation scheme for the FCMC – Dynamic voltage balance of FCMC – Effectiveness boundary of voltage balancing in FCMCs – Performance evaluation and case studies.

**UNIT V FLEXIBLE AC TRANSMISSION SYSTEMS 9**

Introduction – Principle of power transmission – Principle of shunt compensation – Shunt compensators – Principle of series compensation – Series compensators – Principle of phase-angle compensation – Phase-angle compensator – Unified power flow controller – Comparisons of compensators.

**TOTAL: 45 PERIODS**

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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain various multilevel converter topologies and their applications
- Analyze the performance of CAMC and its modulation strategies
- Understand and implement voltage balancing techniques in DCMC converters
- Apply modulation and voltage control methods in FCMC and evaluate performance
- Describe FACTS devices, their working principles and their role in improving power transmission

**TEXT BOOKS:**

1. Sergio Alberto Gonzalez, Santiago Andres Verne, Maria Ines Valla, “Multilevel Converters for Industrial Applications”, First Edition, CRC Press, 2017.
2. BinWu and Mehdi Narimani, “High Power Converters and AC drives”, Second Edition, IEEE press, 2017.

**REFERENCES:**

1. Thomas A Lipo, “Pulse Width Modulation for Power Converters: Principles and Practice”, D’Grahame Holmes, First Edition, John Wiley and Sons, 2003.
2. Fang Lin Luo, Hong Ye, “Advanced DC/AC Inverters: Applications in Renewable Energy”, First Edition, CRC Press, 2017.
3. Hani Vahedi and Mohamed Trabelsi, “Single-DC-Source Multilevel Inverters”, First Edition, Springer, 2019.
4. Ersan Kabalci, “Multilevel Inverters Introduction and Emergent Topologies”, First Edition, Academic Press Inc, 2021.
5. Ali I Maswood and Hossein Dehghani Tafti, “Advanced Multilevel Converters and Applications in Grid Integration”, First Edition, Wiley, 2018.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	2	3	2

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Identify the construction, types, operation and applications of stepper motors
- Understand the construction, working principles and control methods of switched reluctance motors
- Examine the construction, operation, control techniques and applications of PMDC and BLDC motors
- Apply knowledge of construction, operation, equations and control methods to the practical use of PMSM and PMAF machines
- Evaluate the principles, characteristics, and performance of hysteresis, AC series, repulsion, single-phase reluctance, universal and linear electrical machines

**UNIT I STEPPER MOTOR**

9

Constructional features – Principle of operation – Permanent and hybrid – Types – Winding – Torque – Characteristics – Open loop and closed loop control – Microprocessor based control – Applications.

**UNIT II SWITCHED RELUCTANCE MOTOR**

9

Constructional features – Principle of operation – Torque equation and characteristics – Power converter circuits – Control – Rotor position sensor – Current regulator – Microprocessor based control – Sensorless control – Synchronous reluctance motor.

**UNIT III PMDC AND BLDC MOTORS**

9

**PMDC:** Constructional features – Principle of operation – Torque equation and equivalent circuit – Characteristics – Moving coil motor – PC motor – Disc motor – Shell type motor.

**BLDC:** Constructional features – Principle of operation, types – Electronics commutation – Microprocessor based control – DSP and sensorless control – Applications.

**UNIT IV PERMANENT MAGNET SYNCHROUNOUS MOTOR**

9

Constructional features – Principle of operation – EMF and Torque equation – Phasor and circle diagram – Control of Permanent Magnet Synchronous Motor (PMSM) – Permanent Magnet Axial Flux (PMAF) Machines – Applications.

**UNIT V OTHER SPECIAL ELECTRICAL MACHINES**

9

Principle of operation and characteristics of Hysteresis motor – AC series motors – Repulsion motor – Single phase reluctance motor – Universal motor.

Linear Electrical Machines: Linear Induction Motor (LIM), Linear Synchronous Motor (LSM), DC Linear Motor (DCLM) and Linear Reluctance Motor (LRM).

**TOTAL: 45 PERIODS**

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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Recognize the features, working and uses of stepper motors in practical systems
- Identify the types, characteristics and applications of switched reluctance motors
- Outline the construction, operation, characteristics, control methods and applications of PMDC and BLDC motors
- Utilize the knowledge of construction, operation, equations and control methods of PMSM and PMAF machines for practical engineering applications
- Assess the operation, characteristics and performance of hysteresis, AC series, repulsion, single-phase reluctance, universal and linear electrical machines

**TEXT BOOKS:**

1. Janardhanan E G, ‘Special Electrical Machines’, PHI Learning Private Limited, 2014.
2. Venkata Ratnam K, “Special Electrical Machines”, University Press, 2009.

**REFERENCES:**

1. Ramu Krishnan, “Permanent Magnet Synchronous and Brushless DC Motor Drives”, First Edition, CRC Press Inc, Marcel Applications, 2009.
2. Akira Sugawara and Takashi Kenjo, “Stepping Motors and their Microprocessor Controls”, Second Edition, Oxford University Press, 2017.
3. Krishnan R, “Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design and Applications”, First Edition, CRC Press, 2017.
4. Miller T J E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, London, 1989.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	2	2	2	–	–	–	–	–	–	–	2	3	2
<b>CO2</b>	2	2	2	1	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	2	–	–	–	–	–	–	2	3	3

*P. S. Rao*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Provide knowledge on the design of electrical machines
- Design armature and field systems for DC machines
- Impart knowledge on design of transformers
- Analyze various aspects in designing of induction machines
- Summarize the procedure of synchronous machines design

**UNIT I INTRODUCTION**

9

Major consideration in electrical machine design – Electrical engineering materials– Choice of specific electrical and magnetic loadings–Modes of heat dissipation – Thermal state in electrical machines– Types of duties and ratings–methods used for determination of motor ratings– Methods used for determination of motor rating for variable load drives.

**UNIT II DC MACHINES**

9

Output equation –Selection of number of poles – Core length – Net length of iron – MMF for teeth – Real apparent flux densities – Length of air gap – Design of armature – Design of commutator and brushes.

**UNIT III TRANSFORMERS**

9

Output equation of single and phase transformers – Design of core – Window space factor – Design of yoke – Overall dimensions – Determination of no load current – Temperature rise Design of tank – Methods of transformer cooling.

**UNIT IV INDUCTION MOTORS**

9


Output equation of induction motor – Choice of average flux density Main dimensions – Length of air gap – Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars and slots – Design of end rings – Design of wound rotor – No load current – Short circuit current.

**UNIT V SYNCHRONOUS MACHINES**

9

Output equation – Choice of specific electrical and magnetic loading. Design of salient pole machines – Short circuit ratio –Shape of pole face – Armature design – Estimation of air gap length Design of rotor – Determination of full load field MMF – Design of field winding – Design of turbo alternators.

**TOTAL: 45 PERIODS**

  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Exhibit the knowledge on design of various electrical machines
- Analyze the armature and field systems for DC machines
- Design the core, yoke and cooling system of transformers
- Predict the operating characteristics of induction motors
- Calculate the different parameters in synchronous machine design

**TEXT BOOK:**

1. Sawhney A K, "A Course in Electrical Machine Design", Sixth Edition, Dhanpat Rai and Sons, 2016.

**REFERENCES:**

1. Shanmugasundaram A, Gangadharan G and Palani R, "Electrical Machine Design Data Book", Reprint, New Age International Private Limited, 2007.
2. Rajini V and Nagarajan V S, "Electrical Machine Design", First Edition, Pearson Education, 2018.
3. Vishnu Murthy K M, "Computer Aided Design of Electrical Machines", B S Publications, 2008.
4. Deshpande M V, "Design and Testing of Electrical Machines", Third Edition, Prentice Hall India Learning Private Limited, 2010.

**Mapping of COs with POs and PSOs:**

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<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	2	2	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	2	3	3

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

To student should be made to:

- Describe the principles and basic topologies of non-isolated DC–DC converters
- Classify isolated DC–DC converter topologies and their integration into SMPS
- Analyze converter dynamics using state-space methods
- Apply basic control strategies to DC–DC converters
- Assess and implement power conditioning and energy storage interfaces

**UNIT I NON-ISOLATED DC-DC CONVERTERS 9**

Basic topologies: Buck, Boost and Buck-Boost – Principles of operation – Continuous conduction mode – Concepts of volt-sec balance and charge balance – Analysis and design based on steady state relationships – Introduction to discontinuous conduction mode.

**UNIT II ISOLATED DC-DC CONVERTERS 9**

Introduction – Classification: Forward, Flyback, Push pull, Half and Full bridge topologies – CUK converter as cascade combination of boost followed by buck – Isolated version of Cuk converter – Design of SMPS – Simulation of bidirectional DC-DC converter (both non-isolated and isolated) considering EV as an example application.

**UNIT III CONVERTER DYNAMICS 9**

AC equivalent circuit analysis – State space averaging – Circuit averaging – Transfer function model for buck, boost and buck-boost converters – Simulation of basic topologies using state space model derived – Comparison with the circuit model-based simulation.

**UNIT IV CONTROLLER DESIGN 9**

Review of P, PI, and PID control concepts – Gain margin and phase margin – Bode plot based analysis – Design of controller for buck, boost and buck-boost converters.

**UNIT V POWER CONDITIONERS AND UPS 9**

Introduction – Power line disturbances – Power conditioners – UPS: Offline and On-line – Need for filters – Filter for PWM VSI – Front-end battery charger – Boost charger.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the operation of buck, boost and buck–boost converters in continuous conduction mode
- Compare forward, flyback, push–pull, half-bridge and full-bridge converters for isolated power conversion
- Derive transfer functions for buck, boost and buck–boost converters and relate them to time-domain responses
- Design P, PI, and PID controllers for buck, boost and buck–boost converters using Bode plots and stability margins
- Select suitable filters and UPS configurations for power quality and front-end EV charging and boosting

**TEXT BOOK:**

1. Robert W Erickson and Dragon Maksimovic, “Fundamentals of Power Electronics”, Third Edition, Springer-Verlag New York Inc., 2020.
2. Teuvo Suntio, Tuomas Messo, Joonas Puukko, “Power Electronic Converters”, First Edition, 2017.

**REFERENCES:**

1. Ali Emadi, “Handbook of Automotive Power Electronics and Motor Drives”, First Edition, Taylor and Francis, 2005.
2. Timothy Varenina S K, “Power Electronics Handbook, Industrial Electronics Series”, CRC press, 2002.
3. Li Zhai, “Electromagnetic Compatibility of Electric Vehicle”, First Edition, Springer 2021.
4. Bimbhra P S, “Power Electronics”, Seventh Revised Edition, Khanna Publishing House, 2025.
5. Ned Mohan, “Power Electronics: A First Course”, John Wiley and Sons Inc, 2013.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	2	–	–	–	–	–	–	2	3	3

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Learn the characteristics of different motor loads and their impact on system performance
- Explain the principles and applications of power converters for controlling the speed of DC drives
- Describe the operation and control methods of induction motor drives
- Explore the performance analysis techniques for synchronous motor drives under various operating conditions
- Understand the operation of special electrical machines and the control strategies used in industrial applications

**UNIT I DRIVE CHARACTERISTICS 9**

Elements of electrical drives – Choice of electrical drives – Torque balance equation of drive system – Speed torque conventions and multi quadrant operation – Components of load torque – Nature and classification of load torque – Modes of operation – Classes of motor duty – Determination of motor rating – Braking methods.

**UNIT II CONVERTER/ CHOPPER FED DC MOTOR DRIVE 9**

Speed control of DC motors – Steady state analysis of the single and three phase converter fed separately excited DC motor drive – Continuous conduction – Time ratio and current limit control – Class A, B, C, D and E chopper controlled separately excited DC drives – Applications.

**UNIT III INDUCTION MOTOR DRIVES 9**

Stator voltage control – V/f control – Rotor resistance control and slip power recovery schemes – Closed loop control – Vector control – Applications.

**UNIT IV SYNCHRONOUS MOTOR DRIVES 9**

Self-controlled synchronous motor drive employing load commutated thyristor inverter – Self-controlled synchronous motor drive employing a cycloconverter – Permanent Magnet Synchronous Motor (PMSM) drives – Electric traction drive components. – Applications.

**UNIT V BLDC, STEPPER MOTOR DRIVES AND APPLICATIONS 9**

Brushless DC motor drives – Variable reluctance and permanent magnet stepper motor drives – Solar and Battery powered drives – Drives for specific applications: EV drives – Wind mill – Textile mills – Cranes and hoist drives – Steel rolling mills.

**TOTAL: 45 PERIODS**

*RSP*  
 CHAIRMAN  
 BoS (EEE) 16/10/25  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the motor load characteristics
- Apply power converters for speed control of DC drives
- Explain the operation and control of Induction motor drives
- Analyze the performance of synchronous motor drives
- Examine the operation of special electrical machines and control schemes for various industrial applications

**TEXT BOOK:**

1. Gopal K Dubey, "Fundamentals of Electrical Drives", Second Edition, Narosa Publishing House, New Delhi, 2019.

**REFERENCES:**

1. Vedam Subramanyam, "Electric Drives Concepts and Applications", Second Edition, McGraw Hill, 2016.
2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier, 2012.
4. Theodore Wildi, "Electrical Machines, Drives and Power Systems", Sixth Edition, Pearson Education, 2015
5. DW N K and Sen P K, "Electric drives", Printice Hall of India, 2012.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	2	3	2
<b>CO2</b>	3	3	2	2	-	-	-	-	-	-	2	3	3
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	2	3	3

*P. S. B. B. B. B. B.*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Introduce the core principles of active and reactive power compensation and basic power flow modelling in transmission systems
- Analyze the impact of mid-point compensation on voltage, current, and power transfer capability in long transmission lines
- Study the operation, configurations and design principles of thyristor-controlled and switched reactive power compensators
- Assess SVC performance in enhancing stability, voltage regulation, and oscillation damping in power systems
- Understand and apply advanced FACTS controllers for improving power system performance

**UNIT I FUNDAMENTALS OF POWER FLOW ANALYSIS IN TRANSMISSION SYSTEMS 9**

Basic Concepts of active and reactive power – Reactive power compensation – Mathematical modelling of power transmission systems – Derivation of the relation between sending and receiving end voltages and currents. Derivations of power flow expressions – Numerical example showing determination of power flow – Generalized expression for active and reactive power at any point of a long line.

**UNIT II POWER FLOW ANALYSIS AND COMPENSATION TECHNIQUES 9**

Mid-point voltage and current for long, lossless transmission lines – Plot of mid-point voltage versus line loading – Numerical example of mid-point compensation – Effect of Mid-point compensation on power flow of transmission lines.

**UNIT III THYRISTOR BASED STATIC VAR COMPENSATORS 9**

Thyristor controlled reactor (TCR) – Harmonics in TCR and Three-phase TCR configuration – Operating Characteristics of TCR – Categorization of different types of SVC and Fixed capacitor TCR (FC-TCR) – Mechanically Switched Capacitor TCR (MSC-TCR) and Thyristor Switch Capacitor (TSC) – Thyristor Switch Capacitor (TSC) – Design of TSC-TCR: Numerical example.

**UNIT IV MODELING AND APPLICATIONS OF SVC IN POWER SYSTEMS 9**

SVC in enhancement of steady-state power transmission capacity – SVC in enhancement of transient stability of power systems – SVC in enhancement of synchronizing power coefficient – SVC in power system oscillation damping – SVC in voltage control of power systems: Modelling and control characteristics – Numerical example.

*R.P. Bhowmik*  
CHAIRMAN  
BoS (EEE) 16/10/25

**UNIT V FACTS CONTROLLERS FOR POWER SYSTEM APPLICATIONS 9**  
 Basic operating principle of TCSC – Basic mathematical modelling of TCSC – TCSC reactance and harmonics analysis – Applications of TCSC in power systems – Basic mathematical modelling of STATCOM – Applications of STATCOM in power systems – Basic mathematical modelling of SSSC – Applications of SSSC in power systems.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain mathematical models to determine active and reactive power flow in long transmission lines
- Evaluate the improvement in transmission line performance using mid-point compensation through analytical and graphical methods
- Design a suitable TSC–TCR based SVC for specified system requirements with performance validation using numerical calculations
- Analyze the effectiveness of SVC in improving system stability and voltage control under different operating conditions
- Develop FACTS based solutions to enhance power transfer capability and stability in complex transmission networks

**TEXT BOOK:**

1. Mathur R M and Varma R K, “Thyristor-Based FACTS Controllers for Electrical Transmission Systems”, Wiley-IEEE Press, 2011.

**REFERENCES:**

1. Hingorani N G, Gyugyi L, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, Reprint, Wiley, 2012.
2. Padiyar K R, “FACTS Controllers in Power Transmission and Distribution”, Reprint, New Age International Private Limited, 2021.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	2
CO3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

*P. S. Booker*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Categorize and analyze the all types of DC machines
- Develop reference frame equations for various elements like R, L and C
- Model a three phase and 'n' phase induction and synchronous machines
- Estimate reference frame equations for induction and synchronous machine
- Observe the need and working of multiphase induction and synchronous machine

**UNIT I BASICS OF ROTATING ELECTROMAGNETIC MACHINES** 9

Fundamentals of operation – Nature of machine windings and air gap magneto motive force – Machine winding inductance – State model derivation – Construction of a model of DC machine using state equations – Shunt, Series and Compound motors.

**UNIT II REFERENCE FRAME THEORY** 9

Historical background – Phase transformation and commutator transformation – Transformation of variables from stationary to arbitrary reference frame – Steady state voltage equations of passive circuit elements – Choice of speed of arbitrary reference frame.

**UNIT III INDUCTION MACHINES** 9

Three phase induction machine - Equivalent circuit – Free acceleration characteristics – Voltage and torque equations in machine variables and arbitrary reference frame variables – Simulation under no-load and load conditions – Analysis of balanced steady state operation of induction motors.

**UNIT IV SYNCHRONOUS MACHINES** 9

Three phase synchronous machine – Voltage and torque equations in machine variables and rotor reference frame variables – Analysis of synchronous machine dynamics – Simulation model.

**UNIT V MULTIPHASE MACHINES** 9

Preliminary Remarks – Necessity – Evolution – Advantages – Working Principle – Multiphase induction machine – Multiphase synchronous machine – Modeling of 'n' phase machine – Applications.

**TOTAL: 45 PERIODS**

*P. S. Prasad*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Find the modeling for a brushed DC-Motor and to simulate DC motors using state models
- Apply reference frame theory for resistive and reactive elements
- Compute the equivalent circuit and torque of three phase induction motor and synchronous motor in machine variable arbitrary reference frame variable
- Demonstrate the working of multiphase induction and synchronous machine
- Compute the model of three phase and multiphase induction and synchronous machine

### TEXT BOOKS:

1. Ramanujam R, "Modeling and Analysis of Electrical Machines", I K International Publishing House Private Limited, 2018.
2. Krishnan R, "Electric Motor and Drives: Modelling, Analysis and Control", First Edition, Pearson Education, 2015.

### REFERENCES:

1. Stephen D Umans, Fitzgerald and Kingsley's, "Electric Machinery", Seventh Edition, Tata McGraw Hill, 2020.
2. Bogdan M Wilamowski, David Irwin J, "The Industrial Electronics Handbook", Second Edition, Power Electronics and Motor Drives, CRC Press, 2011.
3. Paul C Krause, Oleg Wasynczuk, Scott D Sudhoff, Steven D Pekarek, "Analysis of Electric Machinery and Drive Systems", Third Edition, Wiley-IEEE Press, 2013.
4. Chee Mun Ong, "Dynamic Simulation of Electric Machinery using MATLAB", Prentice Hall, 1997.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	-	-	-	-	-	2	3	2
CO3	3	3	2	2	-	-	-	-	-	-	2	3	2
CO4	3	2	2	2	-	-	-	-	-	-	2	3	2
CO5	3	3	3	2	-	-	-	-	-	-	2	3	2

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Explore advanced converter topologies and PWM methods for AC drives
- Understand modelling and control of induction motor drives
- Learn synchronous motor drive systems and their control strategies
- Gain knowledge of BLDC and PMSM drive configurations and control
- Explore SRM drives and DSP-based digital motion control

**UNIT I POWER CONVERTERS FOR AC DRIVES 9**

PWM control of inverter, selected harmonic elimination, Space vector modulation, Current control of VSI, SVM for 3 level inverter, PWM converter as line side rectifier, Current fed inverters with self-commutated devices. Control of CSI, H bridge as a four-quadrant drive.

**UNIT II INDUCTION MOTOR DRIVES 9**

Different transformations and reference frame theory, Modelling of induction machines, Voltage fed inverter control – V/f control, Vector control, Direct torque and flux control (DTC).

**UNIT III SYNCHRONOUS MOTOR DRIVES 9**

Modelling of synchronous machines, Open loop V/f control, Vector control, Direct torque control and CSI fed synchronous motor drives.

**UNIT IV PERMANENT MAGNET MOTOR DRIVES 9**

Introduction to various PM motors, BLDC and PMSM drive configuration, Comparison, Block diagrams, Speed and torque control in BLDC and PMSM.

**UNIT V SRM DRIVES AND DSP BASED MOTION CONTROL 9**

Evolution of switched reluctance motors, Various topologies for SRM drives, Comparison, Closed loop speed and torque control of SRM – Use of DSPs in motion control – Realization of some basic blocks in DSP for implementation of DSP based motion control.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain advanced converter topologies and PWM strategies for AC drives
- Model and analyze induction motor drives under different control schemes
- Apply vector control and direct torque control techniques to synchronous motor drives
- Evaluate the performance of BLDC and PMSM drives with appropriate control strategies
- Demonstrate knowledge of SRM drives and implement DSP-based real-time motion control

*PSP*  
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BoS (EEE) 16/10/25

**TEXT BOOKS:**

1. Bimal K Bose, “Modern Power Electronics and AC Drives”, Pearson Education Private Limited, New Delhi, 2003.
2. Krishnan R, “Permanent Magnet Synchronous and Brushless DC Motor Drives”, First Edition, CRC Press Inc, 2009.

**REFERENCES:**

1. Krishnan R, “Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design and Applications”, First Edition, CRC press, 2017.
2. Hamid A Toliyat and Steven G Campbell, “DSP Based Electromechanical Motion Control”, First Edition, CRC Press, 2019.
3. Paul Krause, Oleg Wasynczuk, Scott D Sudhoff and Steven D Pekarek, “Analysis of Electric Machinery and Drive Systems”, Third Edition, Wiley-IEEE Press, 2013.
4. Krishnan R, “Electric Motor Drives - Modelling, Analysis and Control”, Prentice- Hall of India Private Limited, New Delhi, 2003.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	2	2	–	–	–	–	–	–	2	3	2

  
**CHAIRMAN**  
**BoS (EEE)**

24EC602PE

**EMBEDDED PROCESSORS  
(COMMON TO EEE AND ECE)**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

The Students Should be made to

- Introduce the fundamental processor architectures used in embedded systems.
- Differentiate between Von Neumann and Harvard architectures and understand their relevance to embedded processors.
- Explore RISC and CISC architectures and their implications for embedded system performance.
- Familiarize students with System-on-Chip (SoC) concepts, architecture, and design approaches.
- Understand memory organization and system buses within an SoC environment.

**UNIT I INTRODUCTION TO EMBEDDED PROCESSORS 9**

Introduction to processors - Von Neumann architecture and Harvard architecture, RISC VS CISC System on Chip (SoC)-Introduction to SoC Architecture, An approach for SOC Design, System Architecture and Complexity. Processor Selection for SOC, Basic concepts in Processor Architecture, Overview of SOC external memory, Internal Memory, Scratchpads and Cache memory, SOC Memory System, Models of Simple Processor - memory interaction, SOC Standard Buses.

**UNIT II EMBEDDED PROCESSORS ON CHIP PERIPHERALS 9**

Memory Interrupts - I/O Ports-Timers & Real Time Clock (RTC), Watch dog timer -CCP modules - Capture Mode - Compare Mode-PWM Mode - Serial communication module USART SPI interface I2C interface, Analog Comparator, Analog interfacing and data acquisition.

**UNIT III ARM PROCESSOR 9**

Architecture of ARM Controller – Registers, Pipeline organization 3 stage & 5 stage, Thumb mode of operation - D/A and A/D converter, sensors, actuators and their interfacing – Case study- Digital clock, Temperature sensing, Light sensing, Introduction to Internet of Things, smart home concepts.

**UNIT IV REAL WORLD INTERFACING USING ARM PROCESSOR 9**

Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SD card interface using SPI, on-chip DAC for waveform generation.

**UNIT V ARM CORTEX PROCESSORS 9**

Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications, need of operating system in developing complex applications in embedded system, Firmware development for ARM Cortex, Survey of CORTEX M3 based controllers, its features and comparison.

**TOTAL :45 PERIODS**

*M. Sharma*  
CHAIRMAN  
BoS (ECE)

## OUTCOMES:

On successful completion of this course, the students will be able to

- Explain the architectural differences between Von Neumann and Harvard architectures and their impact on embedded processor performance.
- Compare RISC and CISC architectures and justify suitable choices for embedded applications.
- Illustrate the structure and operation of a System-on-Chip (SoC), including internal and external memory organization.
- Describe the functioning of cache, scratchpad, and main memory systems in embedded processor design.
- Demonstrate knowledge of SoC standard buses and simple processor–memory interaction models used in embedded systems.

## TEXT BOOKS:

1. F. Vahid and T. Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”, Wiley India Pvt. Ltd., 2002.
2. Michael J. Flynn and Wayne Luk, “Computer System Design System-on-Chip”, Wiley India Pvt. Ltd.

## REFERENCES:

1. Steve Furber, “ARM System on Chip Architecture “, 2nd Edition, 2000, Addison Wesley Professional.
2. S. Pasricha and N. Dutt, Morgan Kaufmann, On-Chip Communication Architectures, System on Chip Interconnect, -Elsevier Publishers 2008.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	1	-	-	-	-	1	-
CO2	3	2	2	2	2	-	-	-	-	1	-
CO3	3	3	3	2	2	-	-	-	1	2	1
CO4	3	2	3	3	3	-	-	-	1	2	1
CO5	3	3	3	3	3	1	1	-	-	2	1

  
CHAIRMAN  
BoS (ECE)

24EC603PE

**PROGRAMMING FOR EMBEDDED SYSTEMS  
(COMMON TO ECE AND EEE)**

LTPC

3 0 0 3

**OBJECTIVES:**

The Students Should be made to

- Introduce the fundamentals of C programming and develop structured and modular programming skills.
- Familiarize students with Embedded C concepts and techniques for real-time programming.
- Provide knowledge on the C programming toolchain in Linux, including compilation, debugging, and performance analysis tools.
- Introduce the Python programming language and its essential constructs for problem-solving.
- Enable students to utilize Python modules, packages, and libraries effectively for scientific, graphical, and networking applications.

**UNIT I BASIC C PROGRAMMING**

9

Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.

**UNIT II EMBEDDED C**

9

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

**UNIT III C PROGRAMMING TOOL-CHAIN IN LINUX**

9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Introduction to GNU C Library.

**UNIT IV PYTHON PROGRAMMING**

9

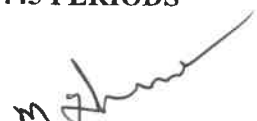
Introduction - Parts of Python Programming Language - Control Flow Statements - Functions - Strings - Lists - Dictionaries - Tuples and Sets.

**UNIT V MODULES, PACKAGES AND LIBRARIES IN PYTHON**

9

Python Modules and Packages - Creating Modules and Packages - Practical Example - Libraries for Python - Library for Mathematical functionalities and Tools - Numerical Plotting Library - GUI Libraries for Python - Imaging Libraries for Python - Networking Libraries.

**TOTAL :45 PERIODS**

  
CHAIRMAN  
BoS (ECE)

## OUTCOMES:

On successful completion of this course, the students will be able to

- Explain the fundamentals of embedded programming and its role in embedded system development.
- Develop programs that meet real-time constraints using hardware delays and timeout mechanisms.
- Use GCC and GDB tools for compiling and debugging C programs.
- Develop simple Python programs for computational and logical problem-solving.
- Create and manage Python modules and packages for program modularity and reuse.

## TEXT BOOK:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall, 1988.
2. Christopher Hills, Embedded Software Development with C, McGraw Hill, 2018.

## REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", 8th Edition, Pearson Education Limited, 2016.
2. Michael J Pont, "Embedded C", Addison-Wesley, An imprint of Pearson Education, 2002
3. William von Hagen, "The Definitive Guide to GCC", 2nd Edition, Apress Inc., 2006.
4. Gowrishankar S and Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019.
5. Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	2	-	-	-	-	-	1
CO2	3	3	3	3	2	-	-	-	-	-	1
CO3	2	3	3	3	3	-	-	-	-	-	1
CO4	3	3	2	2	2	-	-	-	-	-	1
CO5	3	3	3	2	3	-	-	-	-	-	1

  
CHAIRMAN  
BoS (ECE)



**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Describe the types of electric drives and their operational characteristics
- Implement embedded processors and sensor interfaces for motor control applications
- Analyze speed control methods of three-phase induction motors and adaptive techniques
- Compare BLDC and PMSM control strategies and AI-assisted optimization
- Design control schemes for SRM motors and hybrid drives for electric vehicle applications

**TEXT BOOKS:**

1. Ion Boldea and Nasar S A, “Electric Drives”, Third Edition, CRC Press, Taylor and Francis Group, New York, 2017.
2. Lance Harvie, “Advanced Embedded Systems: A Guide for Engineers and Managers”, Run Time Recruitment, 2024.

**REFERENCES:**

1. Bimal K Bose, “Modern Power Electronics and AC Drives”, Printice Hall of India Learning Private Limited, 2013.
2. Malaya Kumar Nayak and Amiya Kumar Rath, “Artificial Intelligence in Electrical and Electronics Engineering”, Springer Nature, 2021.
3. Sabina Jeschke and Christian Brecher, “Industrial Internet of Things and Cyber–Physical Systems: Transforming Industry 4.0”, Springer, 2017.
4. Krishnan R, “Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design and Applications”, CRC Press, 2001.
5. Takashi Kenjo and Shigenobu Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, Oxford University Press, 1985.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	–	–	–	–	–	1	2	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO4	3	2	3	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

  
CHAIRMAN  
BoS (EEE)

24EC606PE

**SENSORS FOR IOT APPLICATIONS  
(COMMON TO ECE AND EEE)**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

The student should be made to:

- Understand the fundamental concepts, characteristics, and components of IoT systems, including sensors, actuators, and domain-specific applications.
- Recognize communication models, IoT protocols, and system management tools such as M2M, SDN, NFV, SNMP, NETCONF, and YANG.
- Demonstrate the use of programming platforms such as Python, Arduino, and Raspberry Pi for IoT device interfacing and data acquisition.
- Develop basic IoT hardware projects by integrating sensors, actuators, and other IoT modules.
- Identify cloud platforms and IoT web services (RESTful APIs, AWS IoT) for data collection, monitoring, and visualization.

**UNIT I INTRODUCTION TO INTERNET OF THINGS** **9**  
 Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, Logical design of IoT – IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home Automation, City, Environment, Energy, Agriculture, Industry and Health & Life style.

**UNIT II INTERNET OF THINGS AND M2M** **9**  
 Introduction, M2M, Software defined networks, network function virtualization, difference between SDN and NFV for IoT, IoT System Management with NETCONF - YANG –Need for IoT System Management, SNMP, NETCONF, YANG, NETOPEER.

**UNIT III IOT SYSTEMS AND IOT PHYSICAL DEVICES & END POINTS** **9**  
 Introduction to python, Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.

**UNIT IV PREPARING OUR IoT PROJECTS AND HARDWARE DESIGN** **9**  
 Creating the sensor project, Creating the actuator project, Connecting LED, Buzzer, Switching High Power devices with transistors, Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor.

**UNIT V IOT PHYSICAL SERVERS AND CLOUD OFFERINGS** **9**  
 Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Amazon Web service for IoT

**TOTAL: 45 PERIODS**

  
 CHAIRMAN  
 BoS /ECE

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Describe the fundamental concepts, characteristics, physical and logical design, sensors, actuators, and domain-specific IoT applications.
- Explain the role of M2M communication, software-defined networks, network function virtualization, and IoT system management protocols like SNMP, NETCONF, and YANG.
- Demonstrate programming skills using Python, Arduino, and Raspberry Pi for interfacing sensors, actuators, and external gadgets.
- Design and implement IoT projects using hardware modules including LEDs, buzzers, sensors (temperature, motion, level, ultrasound), and high-power device switching.
- Utilize cloud platforms and web servers for IoT, including RESTful APIs and AWS IoT services, for data collection, storage, and visualization.

**TEXT BOOKS:**

1. Peter Waher, “Learning Internet of Things”, Packt Publishing, 2015.
2. Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015.

**REFERENCES:**

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.
2. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016.

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	-	2
CO2	3	2	2	-	3	-	-	-	2	-	2
CO3	3	2	2	-	3	-	-	2	2	-	3
CO4	3	3	3	3	3	2	-	2	3	2	3
CO5	3	3	3	2	3	2	-	2	3	3	3

  
CHAIRMAN  
BoS /ECE

24EC501

**IoT AND ITS APPLICATIONS**  
(COMMON TO CSE,ECE AND EEE)

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

The Student should be made to:

- Learn the fundamentals, architecture, and enabling technologies of IoT systems.
- Analyze domain-specific IoT applications and explore relevant connectivity technologies and protocols.
- Understand the architecture and pin configuration of IoT development boards.
- Design IoT systems by interfacing sensors and actuators with Arduino and Raspberry Pi.
- Implement real-time IoT applications in various domains.

**UNIT I FUNDAMENTALS OF IoT** **9**

Introduction to IoT –Characteristics of IoT – Basic Components of IoT - Physical Design of IoT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels and Deployment Templates – M2M - Cloud Models - Classification of Sensors - Classification of Actuators.

**UNIT-II DOMAIN SPECIFIC IoTS , CONNECTIVITY TECHNOLOGIES AND PROTOCOLS** **9**

Domain Specific IoTs:Home Automation, Smart Cities, Environment, Energy, Agriculture, Industry, Health and lifestyle - Connectivity Technologies: Bluetooth, Wi-Fi , ZigBee , RFID - Protocols: MQTT, CoAP.

**UNIT-III IoT DEVELOPMENT BOARDS** **9**

Overview of Arduino - Arduino UNO Board - Arduino Communication Interfaces: UART, I2C, SPI - Arduino IDE - NodeMCU ESP8266 Board - Overview of Raspberry Pi - Linux on Raspberry Pi - Raspberry Pi Board - Raspberry Pi Interfaces –Other IoT devices.

**UNIT IV PROGRAMMING FOR IoT USING ARDUINO AND RASPBERRY PI** **9**

Fundamentals of Arduino Programming – Basic Commands for Arduino - Programming with Arduino: LED, Switch , PIR Sensor, DHT Sensor , Ultrasonic Sensor, Soil Moisture Sensor, Relay, DC Motor, Servo Motor - Introduction to Python - Python Datatypes - Control Flow Statements - Basic Python Commands for Raspberry Pi - Programming Raspberry Pi with Python: Controlling an LED, Interfacing an LED and Switch, Interfacing a LDR.

**UNIT V IoT APPLICATIONS AND CASE STUDIES** **9**

Smart Lighting - Home Intrusion detection –Smart Parking – Structural Health Monitoring- Weather Monitoring - Air Pollution Monitoring - Forest Fire Detection- Smart Irrigation- Patient Health Monitoring.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (ECE)

### OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the characteristics, components, and the physical and logical design of IoT systems.
- Investigate domain-specific IoT applications, connectivity technologies, and protocols for IoT.
- Examine the features of IoT development boards such as Arduino, NodeMCU and Raspberry Pi including their communication interfaces.
- Build IoT systems using Arduino and Raspberry Pi with appropriate I/O devices, actuators, and sensors by applying programming concepts.
- Analyze and evaluate IoT case studies to propose innovative solutions for real-world applications.

### TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on-Approach", 1<sup>st</sup> Edition, Universities press Pvt. Ltd., India, 2015.
2. Jeeva Jose, "Internet of Things", Khanna Book Publishing House, New Delhi, 2018.

### REFERENCES:


1. Sudip Mishra, Anandarup Mukherjee and Arijit Roy, "Introduction to IOT", Cambridge University Press, 2021.
2. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, and Mahendra Swain, "Internet of things with Raspberry pi and Arduino", CRC Press Taylor & Francis Group, 2020.
3. Peter Waher, "Learning Internet of Things", 1<sup>st</sup> Edition, Packt Publishing Ltd, UK, 2015.
4. Srinivasa K.G, Siddesh G.M & Hanumantha, Raju R, "Internet of Things", Cengage learning India, 2019.

### ONLINE RESOURCES:

- <https://www.javatpoint.com/arduino>
- <https://www.electronicwings.com>
- <https://www.theengineeringprojects.com/2018/08/esp8266-pinout-datasheet-features-applications.html>
- <https://nptel.ac.in/courses/108108098>

### MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	1	2	-	2	-	-	-	2
CO3	3	2	-	-	3	-	-	-	-	-	2
CO4	3	2	3	2	3	-	-	-	-	-	3
CO5	3	2	3	3	3	2	3	1	-	2	3

  
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BoS (ECE)

**COURSE OBJECTIVES:**

The students should be made to:

- Describe the core concepts, components and enabling technologies of IoT
- Evaluate IoT system management approaches and prototyping tools
- Compare wireless technologies for appropriate protocols
- Analyze the IoT data lifecycle and extract insights through analytics
- Explain security and safety principles for IoT

**UNIT I CONCEPTS AND BUILDING BLOCKS OF INTERNET OF THINGS 9**

Definition and characteristics of IoT – Things in IoT – IoT protocols – Functional blocks – Communication models and APIs – IoT enabling technologies – IoT levels – Domain specific IoTs – Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

**UNIT II SYSTEM MANAGEMENT AND PROTOTYPING FOR IoT 9**

IoT and M2M – Difference between IoT and M2M – Software defined networking – Network function virtualization for IoT – Need for IoT systems management – SNMP – Limitations of SNMP – CC3200 simple link Wi-Fi module – Block diagram, Features and applications – ESP32 Wi-Fi module – Block diagram, Features and applications.

**UNIT III WIRELESS TECHNOLOGIES FOR IoT 9**

Comparison of wireless technologies – LoRa – LoRa protocol stack – IEEE 802.15.4 PHY layer – Network topologies in LoRa – LoRa applications – Bluetooth low energy profile – Versions of Bluetooth – BLE packet – Bluetooth HDP – IEEE 802.15.6 – NFC – IPv6 over Low-Power WPAN – 6LoWPAN goals and transmission.

**UNIT IV IOT DATA MANAGEMENT AND ANALYTICS 9**

Data generation and collection in IoT systems – IoT data storage – Cloud-based and local storage – Data preprocessing and analysis – Basics of analytics for IoT data – IoT dashboards – Visualization and interpretation of data – Role of machine learning and AI in IoT.

**UNIT V SECURITY AND SAFETY, IOT DESIGN CHALLENGES 9**

Security and safety: Introduction – Systems security – Network security – Generic application security – Application process security and safety – Reliable and secure by design IoT applications – Run-Time monitoring – The ARMET approach – Privacy and dependability – Development challenges – Security challenges.

**TOTAL: 45 PERIODS**

*R.P. Chakraborty*  
CHAIRMAN  
BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Analyze IoT domains and protocols to justify suitable architectures for specific applications
- Compare IoT vs M2M, and assess the impact of SDN/NFV on IoT scalability and operations
- Describe the fundamentals of LoRa, BLE, NFC and 6LoWPAN stacks and their roles in network topology
- Implement basic data storage, preprocessing and visualization to support decision-making
- Examine IoT security threats and mitigation approaches at each development stage

### TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on-Approach", First Edition, Universities Press Private. Limited, India, 2015.
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6", First Edition, John Wiley and Sons, Inc, USA, 2013.

### REFERENCES:

1. Qusay F Hassan, "Internet of Things A to Z: Technologies and Applications", IEEE Press, Wiley, 2018.
2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", First Edition, John Wiley and Sons Limited, UK, 2014.
3. Peter Waher, "Learning Internet of Things", First Edition, PACKT Publishing Limited, UK, 2015.
4. Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", First Edition, A Press Publishers, USA, 2013.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	2	2	-	-	-	-	-	2	3	3
CO3	3	3	3	3	2	-	-	-	-	-	2	3	3
CO4	3	3	2	2	1	-	-	-	-	-	2	2	3
CO5	3	3	3	2	2	-	-	-	-	-	2	3	3

  
CHAIRMAN  
BoS (EEE)

24EE303PE

**INTRODUCTION TO EMBEDDED  
SYSTEM DESIGN**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Identify the key components of the six-box model and their contributions to an embedded system's functionality
- Compare linear and switching regulators used in embedded designs
- Identify common input and output peripherals and their interfacing needs with MSP430
- Describe clock/reset architecture and common interrupt mechanisms used in MSP430 applications
- Summarize UART, SPI and I2C roles for typical use cases in MSP430 projects

**UNIT I EMBEDDED SYSTEM FUNDAMENTALS 9**

Embedded and computer systems overview – Six box model: input, output, Embedded CPU, communication, Host/Storage and power – Microcontroller based design – Modern MCU features and ecosystem elements.

**UNIT II POWER SUPPLY AND MSP430 ARCHITECTURE 9**

Power supply design for embedded systems – Linear and switching regulators – MSP430 overview and CPU architecture – Programming methods and Lunchbox platform.

**UNIT III INTERFACING AND PROGRAMMING ESSENTIALS 9**

Fundamentals of physical interfacing: Connecting input devices (Switches, Keyboard) and output devices (LEDs, Seven Segment Displays) – Interfacing LEDs and switches with MSP430 using Digital I/O – Programming MSP430: Version control basics (Git), Installing and using code composer studio – Introduction to Embedded C.

**UNIT IV MSP430 PERIPHERALS AND SIGNAL PROCESSING 9**

Clock and reset systems – Interrupt sources and ISR design – LCD and 7-Segment interfacing – ADC Interfacing and random number generation – Low power modes – Timer modes and PWM generation.

**UNIT V COMMUNICATION, PROTOTYPING AND PROJECTS 9**

UART, SPI, I2C protocols – Circuit prototyping techniques – FSM based single purpose computers – MSP430 project design and implementation.

**TOTAL: 45 PERIODS**

*D.P. Prasad*  
CHAIRMAN  
BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain embedded CPUs with I/O, memory and power in MCU-based designs
- Analyze MSP430 designs to determine power regulation and consumption requirements
- Implement basic MSP430 digital I/O to connect LEDs and switches for a simple interface
- Design LCD/7-segment display control and ADC interfacing sequences
- Evaluate circuit prototyping steps for a single-purpose FSM computer

### TEXT BOOKS:

1. John Catsoulis, "Designing Embedded Hardware", Second Edition, O'Reilly Media, 2005.
2. Tony Givargis and Frank Vahid, "Embedded System Design: A Unified Hardware / Software Introduction", Student Edition, Wiley, 2006.
3. John H Davies, "MSP430 Microcontroller Basics", First Edition, Elsevier, 2008.

### REFERENCES:

1. Bruce Powel Douglas, "Real time UML: Developing Efficient Objects for Embedded Systems", Second Edition, Addison-Wesley, 1999.
2. Daniel W Lewis, "Fundamentals of Embedded Software where C and Assembly Meet", First Edition, Pearson Education, 2001.
3. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley and Sons, 2002.
4. Steve Heath, "Embedded System Design", Second Edition, Elsevier, 2004.
5. Micheal Barr, "Programming Embedded Systems in C and C++", O'Reilly, 1999.

### ONLINE RESOURCE:

1. [https://swayam.gov.in/nd1\\_noc20\\_ee98/preview](https://swayam.gov.in/nd1_noc20_ee98/preview)

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	2	3	3
CO4	3	3	3	2	1	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	-	-	-	-	-	2	3	3

  
CHAIRMAN  
BoS (EEE)

<b>24EE304PE</b>	<b>INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS (Common to ECE and EEE)</b>	<b>L T P C 3 0 0 3</b>
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**COURSE OBJECTIVES:**

The students should be made to:

- State the key concepts of Industry 4.0 and sensing systems using appropriate terminology
- Identify the layers of an IIoT architecture and the main functions of each layer.
- Classify IIoT analytics concepts to data lifecycle stages in industrial contexts
- Compare cloud and fog computing concepts within IIoT
- Design IIoT applications and case-study solutions for diverse industries

**UNIT I INTRODUCTION TO INDUSTRY 4.0 AND SENSING SYSTEMS 9**

Industry 4.0 – Globalization and emerging issues – The fourth industrial revolution – LEAN production systems – Smart and connected business perspective – Smart factories – Cyber physical systems – Next generation sensors – Collaborative platforms – Product lifecycle management – Augmented Reality (AR) and Virtual Reality (VR) – Artificial Intelligence (AI) – Big Data and advanced analytics – Sensing and actuation – Communication– Networking.

**UNIT II INDUSTRIAL IoT ARCHITECTURE AND LAYERS 9**

Basics of Industrial IoT – Industrial processes – Industrial sensing and actuation – Industrial internet systems – IIoT business models – IIoT reference architecture – IIoT layered architecture – Sensing layer – Processing layer – Communication layer – Networking layer.

**UNIT III BIG DATA ANALYTICS AND SOFTWARE PLATFORMS 9**

IIoT analytics – Introduction to machine learning and data science – R and Julia programming – Data management with Hadoop – Software Defined Networks (SDN) in IIoT – Data center networks.

**UNIT IV CLOUD, FOG COMPUTING AND SECURITY 9**

Cloud computing in IIoT – Fog computing in IIoT – Security in IIoT – Cyber security in Industry 4.0 – Security threats, counter measures and industrial best practices.

**UNIT V APPLICATIONS AND CASE STUDIES 9**

Application domains – Factories and assembly lines – Food Industry – Healthcare – Power plants – Inventory management and quality control – Plant safety and security (including AR/VR safety applications) – Facility management – Oil, chemical and pharmaceutical industries – Applications of UAVs in industries – Case Study: Milk processing and packaging – Manufacturing industries.

**TOTAL: 45 PERIODS**

*PSP*  
**CHAIRMAN**  
 BoS (EEE) 16/10/25

**COURSE OUTCOMES:****On successful completion of this course, the students will be able to,**

- Explain Industry 4.0 components' interaction in smart factories and modern sensing technologies
- Analyze the role of sensing, processing, communication, and networking layers in IIoT
- Illustrate the data flows from data collection to analytics in an IIoT platform and name common tools used in each stage
- Summarize security threats in IIoT and outline at least two countermeasures or best practices
- Evaluate a given industrial scenario to identify potential IIoT applications and benefits

**TEXT BOOKS:**

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016.
2. Sabina Jeschke, Christian Brecher, Tobias Meisen and Dennis Ozdemir, "Industrial Internet of Things: Cyber manufacturing Systems", Springer, 2017.

**REFERENCES:**

1. Jay Lee, Behrad Bagheri and Hung-An Kao, "A Cyber-Physical Systems architecture for Industry 4.0-based manufacturing systems", Manufacturing Letters, Elsevier, 2015.
2. Dieter Uckelmann, Mark Harrison and Florian Michahelles, "Architecting the Internet of Things", Springer, 2011.
3. Rajkumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Elsevier, 2016.

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	–	–	–	–	–	–	–	1
<b>CO2</b>	3	2	2	2	–	–	–	–	–	–	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO5</b>	3	3	2	2	–	–	–	–	–	–	2

*P. S. Prasad*  
**CHAIRMAN**  
**BoS (EEE)**

24EE401PE

**ELECTRIC VEHICLE ARCHITECTURE**  
(Common to ECE and EEE)

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the history, types, and specifications of electric vehicle architectures such as series, parallel, and hybrid configurations
- Learn the fundamentals of vehicle motion including kinetics, dynamics, propulsion power, and tire-road mechanics
- Know the sizing and functioning of powertrain components like gears, clutches, differentials, transmissions, and braking systems for EVs and HEVs
- Explore control strategies for hybrid vehicles focusing on supervisory control and mode selection
- Describe the history, construction, working principles, and charging mechanisms of plug-in hybrid electric vehicles (PHEVs)

**UNIT I VEHICLE ARCHITECTURE AND SIZING (7+2 Skill)**

Electric vehicle: History and evolution of Electric Vehicles – Series, parallel and series parallel architecture, Micro and mild architectures – Mountain bike – Motorcycle – Electric cars and heavy duty EVs – Details and specifications.

**UNIT II VEHICLE MECHANICS (7+2 Skill)**

Introduction – Roadway fundamentals, Laws of motion, Vehicle kinetics, Dynamics of vehicle motion, Propulsion power, Velocity and acceleration, Tire–road mechanics, Propulsion system design.

**UNIT III POWER COMPONENTS AND BRAKES (7+2 Skill)**

Power train component sizing – Gears, Clutches, Differential, Transmission and vehicle brakes – EV power train sizing – HEV power train sizing – Case study.


**UNIT IV HYBRID VEHICLE CONTROL STRATEGY (7+2 Skill)**

Vehicle supervisory control – Mode selection strategy – Model control strategies.

**UNIT V PLUG-IN HYBRID ELECTRIC VEHICLE (7+2 Skill)**

Introduction – History – Comparison with electrical and hybrid electrical vehicle – Construction and working of PHEV – Block diagram and components – Charging mechanisms – Advantages of PHEVs.

**TOTAL: 45 PERIODS**

  
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**BoS (EEE) 16/10/25**

**SKILL DEVELOPMENT ACTIVITIES: (Group Seminar/Mini Project/ Assignment/ Content Preparation / Quiz/ Surprise Test / etc.,)**

**Basics of MATLAB Simulation**

1. Variables and expressions formats, Vectors and matrices
2. Arrays, vectors
3. Matrices, Built-in functions, Trigonometric functions
4. Data types and plotting
5. Simulation of drive cycles

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**


- Describe different electric vehicle (EV) architectures and specify components for various vehicle types
- Construct propulsion systems based on laws of motion for effective vehicle acceleration and velocity regulation
- Design powertrain components and systems for electric and hybrid vehicles
- Create mode selection algorithms to enhance hybrid vehicle operation
- Explain plug-in hybrid electric vehicle (PHEV) components, operation, charging methods and advantages over other EV types

**TEXT BOOKS:**

1. Ali Emadi, "Advanced Electric Drive Vehicles", First Edition, CRC Press, 2017.
2. Mark Warner, "The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles - Includes EV Components, Kits and Project Vehicles", HP Books, 2011.


**REFERENCES:**

1. Mehrdad Ehsani, Yimin Gao, Sebastian E Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. Seth Leitman and Bob Brant, "Build Your Own Electric Vehicle", Third Edition, McGraw-Hill, 2013.
3. Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe and Kari Tammi, "Heavy-duty Electric Vehicles from Concept to Reality", Elsevier Science, 2021.
4. Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban and Jens Bo Holm-Nielsen, "Electric Vehicles Modern Technologies and Trends", Springer, 2020.

  
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**BoS (EEE)**

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	1	-	-	-	-	-	-	1
<b>CO2</b>	3	3	3	2	2	2	-	-	-	-	2
<b>CO3</b>	3	3	3	2	2	2	-	-	-	-	2
<b>CO4</b>	3	3	2	2	1	2	-	-	-	-	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	-	3

  
CHAIRMAN  
BoS (EEE) 16/10/25

**COURSE OBJECTIVES:****The students should be made to:**

- Understand electric vehicle dynamics, including drive cycles, tractive force and energy requirements
- Investigate electric motors for EVs and their speed and torque control strategies
- Develop simulation models for EV control systems using transfer functions and state-space approaches
- Analyze DC–DC converter modeling, PWM control and small-signal dynamics for EV applications
- Design power converter circuits for electric vehicles with isolated and non-isolated topologies

**UNIT I ELECTRIC VEHICLE DYNAMICS 6**

Standard drive cycles – Dynamics of electric vehicles – Tractive force – Maximum speed, torque, power and energy requirements of EVs.

**UNIT II MOTORS FOR ELECTRIC VEHICLES 6**

Introduction – Speed and torque control of above and below rated speed – Speed control of EV in the constant power region of electric motors: DC Motors, Induction Motors, Permanent Magnet Synchronous Motors and Brushless DC Motors.

**UNIT III BASICS OF SIMULATION IN CONTROL SYSTEMS 6**

Transfer Function: Build transfer function, identify poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication factors, Constant, Single and Double integration functions; Single and Double differentiation functions, Single pole and Single zero functions, RHP pole and RHP zero functions), State space modelling – Transfer function from state space model.

**UNIT IV MODELLING OF DC–DC CONVERTERS 6**

Overview of PWM converter modelling – Power stage modelling – PWM block modelling – Voltage feedback circuit and small signal model of PWM converter – Average power stage dynamics – Average models for buck/boost converter – Small signal model of converter power stage.

**UNIT V POWER CONVERTERS FOR ELECTRIC VEHICLES 6**

Introduction to components of Electric Vehicles, Non–Isolated DC–DC converter: Boost, Buck and Buck–Boost converters – Cascading of converters – Isolated DC–DC converters: Flyback and Forward converter – Modes of operation and analysis.

**THEORY: 30 PERIODS**

*Brooker*  
CHAIRMAN  
BoS (EEE)

16/10/25  
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**LIST OF EXPERIMENTS:**

1. Simple simulation exercises of basic control systems.
2. Bode plots and calculation of Gain margin and Phase margin for power stage transfer function via simulation.
3. Design of buck converter and boost converter.
4. Design of PMSM Motor using MATLAB.
5. Perform simulation of different types of power converters and motors used in Electric Vehicles using MATLAB.

**PRACTICAL: 30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Describe electric vehicle dynamics, including drive cycles, tractive force and energy requirements
- Explain electric motors used in EVs and their speed and torque control strategies
- Create simulation models to represent EV control systems with transfer functions and state-space techniques
- Investigate DC–DC converter modeling, PWM control and small-signal dynamics for EV applications
- Develop power converter circuits for electric vehicles with isolated and non-isolated topologies

**TEXT BOOKS:**

1. Iqbal Hussain, “Electric and Hybrid Vehicles: Design Fundamentals”, Third Edition, CRC Press, Taylor and Francis Group, 2021.
2. Robert W Erickson, Dragan Maksimovi and Randall Shaffer, “Fundamentals of Power Electronics”, Second Edition, Kluwer Academic Publishers, 2001.

**REFERENCES:**

1. Dean Frederick and Joe Cho, “Feedback Control Problems using MATLAB and the Control System Tool Box”, First Edition, Cengage learning, 2000.
2. Ali Emadi, “Handbook of Automotive Power Electronics and Motor Drives”, First Edition, Taylor and Francis, 2005.
3. Atif Iqbal, Shaikh Moinoddin and Bhimireddy Prathap Reddy, “Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK”, First Edition, Wiley, 2021.
4. Rabiul Islam Md, Rakibuzzaman Shah Md and Hasan Ali Mohd, “Emerging Power Converters for Renewable Energy and Electric Vehicles: Modeling, Design and Control”, First Edition, CRC Press, 2021.
5. Teuvo Suntio, Tuomas Messo and Joonas Puukko, “Power Electronic Converters”, First Edition, Wiley publications, 2017.

  
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**BoS (EEE)**

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	-	-	-	-	-	-	2	3	2
<b>CO2</b>	3	3	2	2	2	-	-	-	-	-	2	3	2
<b>CO3</b>	3	3	3	3	3	-	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	2	2	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	3	3	-	-	-	-	-	2	3	3

*PSPookst*  
**CHAIRMAN**  
BoS (EEE) 16/10/25 193

**COURSE OBJECTIVES:**

The students should be made to:

- Recall current standards and standardization bodies for electric vehicles
- Describe test procedures for electric motors and controllers using different dynamometers
- Explain the functional safety life cycle, fault tree analysis, and hazard assessment
- Identify EMC problems in various EV subsystems including motor drives and wireless charging
- Describe EMI mechanisms and coupling paths in motor drives and DC–DC converters

**UNIT I ELECTRIC VEHICLE STANDARDIZATION 6**

Introduction – Current status of standardization for electric vehicles – Standardization bodies active in the field – The International Electro Technical Commission – Standardization of vehicle components - Hardware in the Loop (HIL) concepts for EV/HEVs.

**UNIT II TESTING OF ELECTRIC MOTORS AND CONTROLLERS FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES 6**

Test procedure using M–G set, Electric motor, Controller, Application of test procedure and Analysis of test items for the type test – Motor test and controller test (Controller only) – Test procedure using eddy current type engine Dynamometer, Test strategy and Test procedure. Test procedure using AC Dynamometer – Brakes Performance ABS Test.

**UNIT III FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC 6**

Functional safety life cycle – Fault tree analysis – Hazard and risk assessment – Software development – Process models – Development assessments – Configuration management – Reliability – Reliability block diagrams and redundancy – Functional safety and EMC – Functional safety and quality – SAE automotive EMC standards – SAE J551- SAE J 1113 Standards – Functional safety of autonomous vehicles.

**UNIT IV EMC IN ELECTRIC VEHICLES 6**

Introduction – EMC problems of EVs, EMC problems of motor drive, EMC problems of DC–DC converter system, EMC problems of wireless charging system, EMC problem of vehicle controller, EMC problems of Battery Management System, Battery testing (AIS 048) – Range test (AIS 040) – Vehicle EMC requirements.

*P. S. Prasad*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

**UNIT V      EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM      6**

Overview – EMI Mechanism of Motor drive system, conducted emission test of Motor drive system, EMI coupling path, EMI modelling of Motor drive system – Broad band / Narrow band EMI Test. EMI in DC-DC converter, EMI source, The conducted emission High-Frequency, equivalent circuit of DC-DC converter system – EMI coupling path.

**THEORY: 30 PERIODS**

**LIST OF EXPERIMENTS:**

1. Design and simulate motor controller for hybrid electric vehicle applications.
2. Testing and analysis and propulsion motor loading at different speed and torque condition. a) Constant speed Vs constant torque b) Constant speed Vs variable torque c) Changing speed Vs constant torque.
3. Study and testing of the controller in an Electric Vehicle training system.
4. Simulation of EMC analysis for Wireless power transfer EV charging.
5. Design and simulation of EMI filter.

**PRACTICAL: 30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the roles of the International Electrotechnical Commission and HIL concepts in EV/HEV standardization
- Analyze test results for motor and controller performance in EVs and HEVs
- Evaluate software development and reliability models for safety in electric vehicles
- Assess battery management and vehicle EMC requirements
- Formulate testing strategies for conducted emissions in these systems

**TEXT BOOKS:**

1. Ali Emadi, “Handbook of Automotive Power Electronics and Motor Drives”, First Edition, Taylor and Francis, 2005.
2. Li Zhai, “Electromagnetic Compatibility of Electric Vehicle”, First Edition, Springer 2021.

**REFERENCES:**

1. Kai Borgeest, “EMC and Functional Safety of Automotive Electronics”, The Institution of Engineering and Technology, First Edition, 2018.
2. Druce Archam Beault, Colin Branch and Omar M Ramachi, “EMI/EMC Computational Modeling Handbook”, Second Edition, Springer, 2012.
3. Mark Steffika, “Automotive EMC”, First Edition, Springer, 2013.

  
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**BoS (EEE)**

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	2	2	-	-	-	-	2	3	2
<b>CO2</b>	3	3	3	2	2	2	-	-	-	-	2	3	3
<b>CO3</b>	3	3	3	3	2	1	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	3	3	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	3	3	-	-	-	-	-	2	3	3

*P. S. Rao*  
CHAIRMAN  
BoS (EEE) 16/10/25

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the concept, history and applications of Vehicle-to-Grid systems
- Explore the technical, economic and environmental benefits of V2G
- Access the technical, economic, regulatory and political challenges associated with V2G adoption
- Examine the impact of EV integration and V2G on smart grids and renewable energy systems
- Describe the Machine-to-Machine (M2M) communication and management strategies for large-scale EV grid integration

**UNIT I INTRODUCTION TO V2G 9**

History and development of V2G – Incorporating V2G to the EV – Auditing and metering, V2G in practice – Power markets and applications of V2G – Electricity markets and V2G suitability, Long-Term storage, Renewable energy and other Grid applications – Beyond the Grid: Other concepts related to V2G.

**UNIT II BENEFITS OF V2G 9**

Technical benefits: Storage superiority and grid efficiency – Economic benefits: EV owners and societal savings – Environment and health benefits: Sustainability in electricity and transport – Other benefits.

**UNIT III CHALLENGES OF V2G 9**

Technical challenges – Battery degradation, Charger efficiency, Aggregation and communication, V2G in a digital society – The economic and business challenges to V2G – Evaluating V2G costs and revenues, EV costs and benefits – Regulatory and political challenges to V2G, V2G and regulatory frameworks – Market design challenges – Other V2G regulatory and legal-challenges.

**UNIT IV IMPACT OF EV AND V2G ON THE SMART GRID AND RENEWABLE ENERGY SYSTEMS 9**

Motor vehicle ownership and EV migration – Impact of estimated EVs on electrical network – Impact on drivers and the smart grid – Standardization and Plug-and-Play – IEC 61850 communication standard and IEC 61850-7-420 extension.

**UNIT V GRID INTEGRATION AND MANAGEMENT OF EVs 9**

Introduction – Machine to Machine (M2M) in distributed energy management systems – M2M communication for EVs – M2M communication architecture (3GPP) – Electric vehicle data logging – Scalability of electric vehicles – M2M communication with scheduling.

**TOTAL: 45 PERIODS**

*P. S. Booker*  
CHAIRMAN  
BoS (EEE) 16/10/25

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Recall the history, development and standardization of Vehicle-to-Grid (V2G) technology
- Describe the benefits of V2G including technical, economic and environmental aspects
- Identify challenges in V2G such as battery degradation, communication and regulatory issues
- Analyze the impact of EV and V2G integration on the smart grid and renewable energy systems
- Design grid integration and management strategies for Electric Vehicles using M2M communication protocols

**TEXT BOOKS:**

1. Lance Noel, Gerardo Zarazua de Rubens, Johannes Kester and Benjamin K Sovacool, “Vehicle-to-Grid a Sociotechnical Transition beyond Electric Mobility”, First Edition, Palgrave Macmillan, 2019.
2. Junwei Lu and Jahangir Hossain, “Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid”, First Edition, IET, 2015.

**REFERENCES:**

1. Nand Kishor and Jesus Fraile-Ardanuy, “ICT for Electric Vehicle Integration with the Smart Grid”, First Edition. The Institute of Engineering and Technology (IET), 2020,
2. Ali Emadi, “Advanced Electric Drive Vehicles”, First Edition, CRC Press 2017.
3. Sumedha Rajakaruna, Farhad Shahnian and Arindam Ghosh, “Plug in Electric Vehicles in Smart Grids, Charging Strategies”, First Edition, Springer, 2015.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	2	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	2	3	3	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	2	2	2	–	–	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	3	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	2	–	–	–	–	–	–	2	3	2

  
**CHAIRMAN**  
**BoS (EEE)**

24EE405PE

**INTELLIGENT CONTROL OF ELECTRIC  
VEHICLES**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Describe the architecture and basic components of Electric Vehicles
- Illustrate the function of converters and inverters in EVs
- Explain ICT needs and benefits in EV systems
- Evaluate AI techniques for energy efficiency and range prediction
- Design a plan for selecting microcontrollers and embedded systems in EVs

**UNIT I FUNDAMENTALS OF ELECTRIC VEHICLES AND DRIVE SYSTEMS 9**

Introduction to EVs: History, Types and architecture – EV components: Batteries, Motors, Controllers – Electric propulsion systems: BLDC, PMSM and IM – Braking and Energy management system – Introduction to drive cycles (UDDS, FTP-75, WLTP).

**UNIT II POWER ELECTRONICS AND MOTOR CONTROL FOR EVs 9**

Converters and Inverters – Motor drive control techniques: V/f, Vector control and DTC – Battery Management System (BMS) and charging control – Thermal and fault protection – Embedded control of motors using ARM.

**UNIT III INTELLIGENT CONTROL TECHNIQUES 9**

ICT needs and benefits – Fuzzy Logic Control (FLC) for EV systems – Neural network and adaptive control – Genetic control and swarm optimization techniques – Case studies: Energy optimization using AI techniques.

**UNIT IV ARTIFICIAL INTELLIGENCE IN ELECTRIC VEHICLE SYSTEMS 9**

AI for energy efficiency and range prediction – Machine learning for driver behaviour analysis – Predictive maintenance using AI/ML – Intelligent route and load scheduling – Integration of AI with IoT and Telematics in EVs.

**UNIT V REAL-TIME EMBEDDED CONTROL AND APPLICATIONS 9**

Microcontrollers and Embedded systems in EVs – CAN, LIN and Vehicle communication protocols – Real-Time Operating Systems (RTOS) for EV control – Hardware-In-Loop (HIL) and simulation tools – Case studies using MATLAB/Simulink.

**TOTAL: 45 PERIODS**

*P. S. S. S. S.*  
**CHAIRMAN**  
BoS (EEE) 16/11/25  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain how batteries, motors and controllers interact in an EV drive train
- Analyze power electronics blocks in an EV drive system
- Demonstrate ICT-enabled improvements in EV efficiency and performance
- Assess AI-based energy optimization models for EVs
- Create a microcontroller selection framework for an EV subsystem

**TEXT BOOKS:**

1. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals”, Third Edition, CRC Press, 2021.
2. Mehrdad Ehsani, Yimin Gao, Stefano Longo and Kambiz Ebrahimi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, Third Edition, CRC Press, 2018.

**REFERENCES:**

1. Mehrdad Ehsani, Yimin Gao, Sebastien E Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, Third Edition, CRC Press, 2018.
2. Perera L P, “Intelligent Transportation and Planning: AI and ML for Smart Mobility”, Springer, 2021.
3. Perry T, “Vehicle Propulsion Systems: Introduction to Modelling and Optimization”, Second Edition, Springer, 2015.
4. MATLAB/Simulink Documentation and Model-Based Design for EVs (MathWorks).

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO3	3	3	3	3	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	2	–	–	–	–	–	–	2	3	3

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The student should be made to:

- Learn the fundamentals of BMS and their impact on design decisions
- Analyze BMS functionality for a given pack topology and justify architectural choices
- Evaluate SOC/SOH methods and experiments to validate estimates
- Develop the models to simulate EV operation and assess performance
- Compare multi-battery balancing methods and cell-balancing techniques

**UNIT I INTRODUCTION 9**

Introduction to Battery Management System (BMS) – Cells and batteries – Nominal voltage and capacity – C rate – Energy and power: Cells connected in series and parallel – Electrochemical and lithium-ion cells – Rechargeable cell – Charging and discharging process – Overcharge and Undercharge – Modes of charging.

**UNIT II BATTERY MANAGEMENT SYSTEM REQUIREMENTS 9**

Introduction and BMS functionality – Battery pack topology – BMS Functionality – Voltage sensing – Temperature sensing – Current sensing – BMS functionality – High voltage contactor control – Isolation sensing – Thermal control – Protection – Communication interface – Range estimation – SOC estimation.

**UNIT III BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION 9**

Preliminary definitions. - Battery state of charge estimation (SOC) – Voltage based methods to estimate SOC, Model based state estimation - Battery State of Health Estimation (SOH) - Lithium-ion aging: Negative and positive electrode.

**UNIT IV MODELLING AND SIMULATION 9**

Equivalent Circuit Models (ECMs) – Physics Based Models (PBMs) – Empirical modelling approach – Physics based modelling approach – Simulating an electric vehicle – Vehicle range calculations – Simulating constant power and voltage – Simulating battery packs.

**UNIT V DESIGN OF BMS 9**

Design of BMS: Principles, Effect of distance, load and force on battery life – Energy balancing with multi-battery system – Types of cell balancing.

**TOTAL: 45 PERIODS**

*R. Brooks*  
CHAIRMAN  
BoS (EEE) 16/10/25

## COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the architecture and basic components of Battery Management Systems (BMS)
- Describe BMS functionality and pack topology
- Explain State of Charge and State of Health estimation for batteries
- Demonstrate modeling and simulation approaches for BMS-enabled EVs
- Design a BMS subsystem for cell balancing and protection strategies

## TEXT BOOKS:

1. Gregory L Plett. "Battery Management Systems, Volume I: Battery Modeling", Artech House, 2015.
2. Plett G, "Battery Management Systems: Volume II, Equivalent-Circuit Methods", Artech House, 2015.

## REFERENCES:

1. Bergveld H J, Kruijt W S and Notten P H L, "Battery Management Systems - Design by Modelling", Philips Research Book Series, 2001.
2. Davide Andrea, "Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010.
3. Valer Pop, Henk Jan Bergveld, Dmitry Danilov, Paul Regtien P L and Peter Notten H L, "Battery management systems: Accurate State – of – Charge Indication for Battery powered applications". Volume 9, Springer Science and Business Media, 2008.

## Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	–	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	–	–	–	–	–	–	3	3	3
CO4	3	3	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	3	2	–	–	–	–	–	–	3	3	3

  
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BoS (EEE)



**OUTCOMES:****On successful completion of this course, the students will be able to,**

- Summarize hybrid drivetrain requirements for a vehicle.
- Interpret suitable hybrid and electric drive-train systems for various vehicle applications.
- Select appropriate AC and DC drive systems for electric vehicles.
- Identify the optimal energy storage solutions for hybrid and electric vehicles.
- Apply energy management strategies to enhance vehicle economy, performance, and operational efficiency.

**TEXT BOOKS:**

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, New York CRC Press Taylor & Francis Group, 2022
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

**REFERENCES:**

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons, 1998
3. Hybrid, Electric and Fuel-Cell Vehicles, International Edition by Jack Erjavec ,6 June 2012
4. Energy Management in Hybrid Electric Vehicles using Co-Simulation by Christian Paar ,11 February 2011
5. Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids (MECHANICAL ENGINEERING) by Yangsheng Xu , Jingyu Yan, et al. ,16 December 2013

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	-	-	-
CO2	2	2	1	-	2	2	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-
CO4	3	2	2	-	2	2	-	-	-	-	-
CO5	2	2	2	-	2	2	-	-	-	-	-



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(BoS / MECH)



**COURSE OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand physical and logical IoT design, including architecture layers data flows and reliability considerations.
- Demonstrate real-time IoT development, covering deployment, monitoring and fault handling
- Assess EV architectures and performance, focusing on efficiency, range and thermal implications
- Appraise EV models for efficiency, performance and lifecycle impact by using simulated data
- Propose IoT-enabled EV solutions, outlining feasibility, scalability and potential operational benefits

**TEXT BOOKS:**

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things A Hands-On Approach”, Universities Press, 2015.
2. James Larminie and John Lowry, “Electric Vehicle Technology Explained”, Second Edition, John Wiley and Sons Publication, 2012.

**REFERENCES:**

1. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, Taylor and Francis Group, 2015.
2. Sheldon S Williamson, “Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles”, Springer, 2013.
3. Jack Erjave C and Jeff Arias, “Alternate Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cenage, 2012.
4. Husain I and Boca Raton, “Electric and Hybrid Vehicles”, CRC Press, 2010.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	–	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	3	2	2	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	2	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	3	2	–	–	–	–	–	2	3	3

*R. S. R. R.*  
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**BoS (EEE)**



## UNIT V APPLICATIONS OF AI TECHNIQUES

9

Load forecasting Mutation – ANN Applications to Load flow studies Mutation – Applications of evolutionary algorithms for economic load dispatch Mutation – Applications of Fuzzy controller for load frequency control Mutation – Single area system and two area system Mutation – Small signal stability Mutation – Reactive power control Mutation. Introduction to Genetic Algorithm and Application of Genetic Algorithm to Simple Optimization Problems.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the components and architecture of artificial neural networks
- Implement backpropagation and use self-organizing maps for pattern recognition
- Examine the concepts of fuzzy set over classical set theory
- Apply genetic algorithm operators like selection, crossover, and mutation to solve simple optimization problems
- Analyze AI techniques to solve power system problems like load forecasting

### TEXT BOOKS:

1. Rajasekharan and Pai, “Neural Networks, Fuzzy logic, Genetic Algorithm – Synthesis and Applications”, Second Edition, Prentice Hall of India, 2017.
2. Sivanandam S N, Sumathi S and Deepa S N, “Soft Computing Techniques”, Third Edition, Wiley Publications, 2018.

### REFERENCES:

1. Karray F and De Silva C, “Soft Computing and Intelligent Systems Design, Theory, Tools and Applications”, First Edition, Prentice Hall, 2009.
2. Deb K, “Optimization for Engineering Design – Algorithms and Examples”, Second Edition, Prentice Hall of India, New Delhi, 2012.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	3	2	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	–	–	2	–	–	–	2	3	3
CO4	3	3	3	3	–	–	2	–	–	–	2	3	3
CO5	3	3	3	3	–	2	3	–	–	–	2	3	3

  
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BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Familiarize students with the data science process
- Understand the data manipulation functions in Numpy and Pandas
- Explore different types of machine learning approaches
- Impart knowledge on visualization techniques using tools
- Describe handling large volumes of data with case studies

**UNIT I INTRODUCTION 9**

Data Science: Benefits and uses – Facets of data – Data Science process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – Build the model – Presenting findings and building applications – Data Mining – Data Warehousing – Basic statistical descriptions of Data – Data cleaning – Tools for Data Science.

**UNIT II DATA MANIPULATION 9**

Python Shell – Jupyter Notebook – IPython Magic Commands – NumPy Arrays – Universal functions – Aggregations – Computation on arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data indexing and selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and grouping – String operations – Working with time series – High performance.

**UNIT III MACHINE LEARNING 9**

The modeling process – Types of machine learning – Supervised learning – Unsupervised learning – Semi-supervised learning – Classification, regression – Clustering – Outliers and Outlier analysis – Deep Learning: Neural Networks, Convolutional Neural Networks and Recurrent Neural Networks – Natural Language Processing: Text analytics, Sentiment analysis.

**UNIT IV DATA VISUALIZATION 9**

Importing Matplotlib – Simple line plots – Simple scatter plots – Visualizing errors – Density and contour plots – Histograms – Legends – Colors – Subplots – Text and annotation – Customization – Three dimensional plotting – Geographic data with basemap – Visualization with Seaborn, Interactive visualizations – Creating dynamic and interactive plots using Plotly, Bokèh and ipywidgets.

**UNIT V HANDLING LARGE DATA 9**

Problems – Techniques for handling large volumes of data – Programming tips for dealing with large data sets – Case studies: Predicting malicious URLs, Building a recommender system – Tools and techniques needed – Research question – Data preparation – Model building – Presentation and automation, Distributed Computing for Big Data, Cloud-based Data processing and storage.

**TOTAL: 45 PERIODS**

*PSP*  
**CHAIRMAN**  
 BoS (EEE) 16/10/25  
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**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the data science process
- Perform data manipulation functions using Numpy and Pandas
- Compare different types of machine learning approaches
- Analyze data visualization using tools
- Apply large volumes of data in practical scenarios

**TEXT BOOKS:**


1. David Cielen, Arno D B Meysman and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

**REFERENCES:**

1. Robert S Witte and John S Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
2. Allen B Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	-	-	-	-	-	-	2	3	3

  
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 BoS (EEE)

**24AD302PE DATA WAREHOUSING AND DATA MINING L T P C**  
 (COMMON TO AD, CSE AND EEE) **3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Introduce the foundational concepts of data warehousing and OLAP
- Enable students to understand and apply data mining techniques
- Provide skills for frequent pattern mining and association rule learning
- Develop proficiency in classification and clustering methods
- Expose students to advanced concepts in web mining and distributed data mining

**UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9**

Basic Concepts - Data Warehousing Components - Building a Data Warehouse - Database Architectures for Parallel Processing - Parallel DBMS Vendors - Multidimensional Data Model - Data Warehouse Schemas for Decision Support - Concept Hierarchies - Characteristics of OLAP Systems - Typical OLAP Operations, OLAP and OLTP.

**UNIT II DATA MINING - INTRODUCTION 9**

Introduction to Data Mining Systems - Knowledge Discovery Process - Data Mining Techniques - Issues - Applications - Data Objects and Attribute Types - Statistical Description of Data - Data Preprocessing - Cleaning, Integration, Reduction, Transformation and Discretization - Data Visualization - Data Similarity and Dissimilarity Measures.

**UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations - Mining Methods - Pattern Evaluation Method - Pattern Mining in Multilevel, Multi-Dimensional Space - Constraint-Based Frequent Pattern Mining - Classification Using Frequent Patterns.

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification - Rule-Based Classification - Classification by Back Propagation - Support Vector Machines - Lazy Learners - Model Evaluation and Selection - Techniques to Improve Classification Accuracy. Clustering Techniques - Cluster Analysis - Partitioning Methods - Hierarchical Methods: Agglomerative and Divisive - Model Based Clustering Methods: Fuzzy clusters and Expectation Maximization Algorithm

**UNIT V WEB MINING AND PATTERN MINING 9**

Web Mining - Mining the web page layout structure - mining web link structure - mining multimedia data on the web - Automatic classification of web documents and web usage mining - Distributed Data Mining. Recent trends in Distributed Warehousing and Pattern Mining - Class Imbalance Problem - Graph Mining - Social Network Analysis.

**TOTAL: 45 PERIODS**

  
**CHAIRMAN**  
**BoS (AD)**

**COURSE OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand and explain the architecture, components, and operations of data warehousing and OLAP systems
- Apply knowledge discovery techniques and perform data preprocessing for real-world data mining applications
- Implement frequent pattern mining methods and evaluate pattern mining in multilevel and multidimensional spaces
- Perform classification and clustering using various machine learning models and evaluate the performance of models
- Analyze and apply web mining techniques and address recent challenges like distributed mining, class imbalance, and graph-based mining

**TEXT BOOKS:**

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, 4th Edition, Elsevier Publication, 2022.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2019.

**REFERENCES:**

1. G Dong and J Pei, Sequence Data Mining, Springer, 2010.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit, 3<sup>rd</sup> Edition, Publisher: Wiley, 2013.

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	-	-	1
CO2	2	3	2	2	3	-	-	-	-	-	1
CO3	2	2	3	2	3	-	-	-	-	-	2
CO4	2	3	3	3	3	-	-	-	-	-	2
CO5	2	3	3	2	3	-	-	-	-	-	3

  
 CHAIRMAN  
 BoS (AD)



### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concepts, architecture and learning rules of artificial neural networks
- Describe the architecture and function of perceptrons and distinguish between heteroassociative and autoassociative memory networks
- Implement feedback and feedforward neural network architectures
- Identify features and applications of special networks like Boltzmann machines and support vector machines for classification
- Apply neural network models to real-world problems in forecasting, bioinformatics and image compression

### TEXT BOOK:

1. Sivanandam S N, Sumathi and Deepa S N, "Introduction to Neural Networks Using MATLAB 6.0", Tata McGraw-Hill Education, 2016.

### REFERENCES:

1. Rajasekaran S. and Pai G A V, "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications", Printice Hall of India, New Delhi, 2017.
2. Martin T Hagan, Howard B Demuth, Mark Hudson Beale and Orlando De Jesús. "Neural Network Design", Second Edition, 2014.
3. Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson Education India, 2006.
4. Simon Haykin, "Neural Networks-A comprehensive Foundation", Pearson Education, 2003.
5. Sivanandam S N and Deepa S N, "Principles of Soft Computing Techniques", Wiley, 2018.
6. Haykin and Simon. "Neural Networks and Learning Machines", Third Edition, Pearson Education India, 2009.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	–	–	–	–	–	–	2	3	3
CO2	3	3	3	2	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:****The students should be made to:**

- Understand the different aspects of imprecision including fuzziness and the relation between fuzzy sets and crisp sets
- Learn the properties and operations of fuzzy sets including union, intersection and complement
- Know fuzzy reasoning through linguistic variables, propositions and inference rules
- Explore methodologies for constructing fuzzy systems including direct and indirect methods
- Examine applications of fuzzy logic in controllers, decision making and hybrid neuro-fuzzy systems

**UNIT I INTRODUCTION 9**

Different faces of imprecision – Inexactness – Ambiguity – Undecidability – Fuzzyness and certainty – Fuzzy sets and crisp sets – Probability and fuzzy logic – Fuzzy control and knowledge based systems.

**UNIT II FUZZY SETS AND OPERATIONS 9**

Impressive concepts – Fuzzyness and imprecision – Properties of fuzzy sets – Fuzzy representation – Conventional set operations – Intersection of fuzzy sets – Union of fuzzy sets – The complement of fuzzy sets.

**UNIT III FUZZY REASONING 9**

Linguistic variables, Fuzzy propositions, Fuzzy compositional rules of inference – The Min-Max rules implications and fuzzy additive rules of implication – Methods of decompositions and defuzzification – Composite moments, composite maximum average of maximum values and centre of maximums.

**UNIT IV METHODOLOGY OF FUZZY SYSTEMS 9**

Direct and Indirect methods with single and multiple experts – Construction from sample data – Least square method – Adaptive fuzzy controllers – Membership function tuning using gradient decent.

**UNIT V APPLICATIONS 9**

Fuzzy controllers – A fuzzy steam turbine controller – DC motor speed control – Fuzzy decisions making – Neuro fuzzy systems – Fuzzy genetic algorithms.

**TOTAL: 45 PERIODS**

*R.P.S. Baker*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concept of fuzziness and how fuzzy sets differ from crisp sets
- Describe fuzzy set operations such as union, intersection, and complement
- Apply fuzzy compositional rules of inference using linguistic variables and fuzzy propositions to perform reasoning
- Construct fuzzy systems from sample data using both direct and indirect methods
- Apply fuzzy logic controllers, decision-making systems, and neuro-fuzzy hybrids to real-world problems

### TEXT BOOKS:

1. Zimmermann H J, "Fuzzy Set Theory - and its Applications", Fourth Edition, Springer, 2007.
2. Timothy J Ross, "Fuzzy Logic with Engineering Applications", Fourth Edition, Wiley Publications, 2016.

### REFERENCES:

1. John Yen and Reza Langari, "Fuzzy Logic, Intelligence, Control and Information", Pearson Education Inc, India, 2007.
2. Zdenko Kovacic and Stjepan Bogdan, "Fuzzy Controller Design Theory and Applications", First Edition, CRC Press, 2006.
3. Riza C Berkaan and Sheldon L Trubatch, "Fuzzy Systems Design Principles – Building Fuzzy If-Then Rule Bases", IEEE Press, 1997.
4. George J Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Pearson, 2015.
5. Mitchell M, "Introduction to Genetic Algorithms", Second Edition, Indian Reprint, MIT press Cambridge, 2014.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	–	–	–	–	–	2	3	2
CO2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO3	3	3	3	2	–	–	–	–	–	–	2	3	2
CO4	3	3	3	3	–	–	–	–	–	–	2	3	2
CO5	3	3	3	3	–	–	–	–	–	–	2	3	2

  
CHAIRMAN  
BoS (EEE)

24CS702PE	<b>MACHINE LEARNING FOR ENGINEERING AND SCIENCE APPLICATIONS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
	(Common to CSE & EEE)	

**OBJECTIVES:**

**The Student should be made to:**

- Understand a strong foundation in the mathematical principles underlying AI and ML.
- Utilize supervised learning approaches to address real-world problems.
- Construct and optimize neural network models for diverse application domains.
- Investigate classical algorithms and ensemble techniques in machine learning.
- Create and apply generative as well as probabilistic models for intelligent systems.

**UNIT I MATHEMATICAL FOUNDATIONS FOR AI & ML 9**

Overview - Introduction to Machine Learning, Linear Algebra - Probability - Computational Basics - Numerical computation and optimization

**UNIT II LINEAR AND LOGISTIC REGRESSION 9**

Introduction to Machine Learning packages - Linear and Logistic Regression - Bias/Variance Tradeoff - Regularization- Variants of Gradient Descent - MLE - MAP

**UNIT III NEURAL NETWORKS AND PERCEPTRON 9**

Neural Networks - Multilayer Perceptron - Backpropagation - Applications Convolutional Neural Networks - CNN Operations - CNN architectures - Training -Transfer Learning

**UNIT IV RECURRENT NEURAL NETWORKS 9**

RNN - Training RNN - LSTM - Bi-RNN - GRU - Bayesian Regression - Binary Trees - Random Forests - SVM- Naive Bayes – Applications - Gradient boosting - Unsupervised learning - Kmeans - Agglomerative clustering

**UNIT V ADVANCED ML & GENERATIVE MODELS 9**

Advanced Techniques - Structured Probabilistic Models - Monte Carlo Methods- Autoencoders - Variational Auto-encoders (VAE) - Generative Adversarial Networks (GAN)- Application

**TOTAL: 45 PERIODS**

*C. J. S. S. S.*  
CHAIRMAN  
BoS (CSE) 15/10/25

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand mathematical foundations to solve AI/ML problems.
- Implement supervised learning algorithms using ML libraries.
- Design and analyze deep learning architectures for applications.
- Evaluate ML models and clustering algorithms with metrics.
- Develop generative models like VAEs and GANs for AI applications.

**TEXT BOOK:**

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning”, MIT Press, 2016.

**REFERENCES:**

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Aurelien Geron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, 3<sup>rd</sup> Edition, O’Reilly, 2023.

**COs - POs Mapping**

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	2	2	2	2	1	-	-	-	2
2	3	3	2	2	3	3	1	-	-	-	2
3	3	3	3	2	3	3	1	-	-	-	2
4	3	3	2	3	3	3	1	-	-	-	2
5	3	3	3	2	3	3	1	-	-	-	3
<b>Average</b>	<b>3.00</b>	<b>3.00</b>	<b>2.40</b>	<b>2.20</b>	<b>2.80</b>	<b>2.80</b>	<b>1.00</b>	-	-	-	<b>2.20</b>

  
 CHAIRMAN  
 BoS (CSE)

**24CS601PE                    AUGMENTED REALITY / VIRTUAL REALITY                    L   T   P   C**  
**(Common to AD, CSE, ECE, EEE & IT)                    3   0   0   3**

**OBJECTIVES:**

**The Student should be made to:**

- Introduce the fundamental concepts and differences between Augmented Reality (AR) and Virtual Reality (VR).
- Explore various tools, platforms, and technologies used in AR/VR development.
- Understand the working principles of sensor devices used in AR/VR systems.
- Learn modeling techniques for designing virtual and augmented environments.
- Develop simple AR/VR applications for use in diverse real-world domains.

**UNIT I                    INTRODUCTION                    9**

History of AR - Augmented Reality characteristics - Introduction to Virtual Reality and Augmented Reality - Definition - Introduction to Trajectories and Hybrid Space - Three I's of Virtual Reality - Virtual Reality Vs 3D Computer Graphics - Benefits of Virtual Reality - Components of VR System - Input Devices - 3D Position Trackers - Types of Trackers - Navigation and Manipulation Interfaces - Gesture Interfaces - Types of Gesture - Input Devices - Output Devices - Graphics Display - Human Visual System - Personal Graphics Displays - Large Volume Displays - Sound Displays - Human Auditory System.

**UNIT II                    VR MODELING                    9**

Modeling - Geometric Modeling - Virtual Object Shape - Object Visual Appearance - Kinematics Modeling - Transformation Matrices - Object Position - Transformation Invariants - Object Hierarchies - Viewing the 3D World - Physical Modeling - Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Behavior Modeling - Model Management - Software tools available for VR.

**UNIT III                    AUGMENTED REALITY                    9**

Introduction to Augmented Reality - Augmented Reality methods - Computer vision for AR - Interaction - Modelling and Annotation - Navigation - Wearable devices

**UNIT IV                    AR AND VR PROGRAMMING                    9**

AR and VR Libraries - VR Programming - Toolkits and Scene Graphs - World ToolKit - Java 3D - Comparison of World ToolKit and Java 3D - 3D Manipulation tasks - Interaction Techniques for 3D Manipulation.

  
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**UNIT V APPLICATIONS**

9

Human Factors in VR - Methodology and Terminology - VR Health and Safety Issues - VR and Society - Medical Applications of VR - Military VR Applications - Emerging Applications of VR - VR Applications in Manufacturing - Applications of VR in Robotics - Information Visualization - VR in Business - VR in Entertainment - VR in Education.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand the basic concepts of AR and VR.
- Explain the tools and technologies related to AR/VR.
- Analyze the working principles and functionalities of AR/VR-related sensor devices.
- Design of various models using modeling techniques.
- Develop AR/VR applications in different domains.

**TEXT BOOKS:**

1. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016.
2. William R. Sherman, Alan B. Craig: “Understanding Virtual Reality - Interface, Application, Design”, Morgan Kaufmann, 2018.

**REFERENCES:**

1. John Vince, “Introduction to Virtual Reality”, Springer Verlag, 2004.
2. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile and Desktop”, Packt Publisher, 2018.
3. Erin Pangilinan, Steve Lukas, and Vasanth Mohan, "Creating Augmented and Virtual Realities: Theory and Practice for Next- Generation Spatial Computing", 1st Edition, O'Reilly Media, 2019.

**COs - POs Mapping**

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	2	-	3	-	-	2	2	1	2
2	3	2	2	1	3	-	-	3	2	2	3
3	3	3	2	2	3	-	-	3	2	1	2
4	3	3	3	2	3	-	-	3	2	2	3
5	3	3	3	3	3	-	-	3	3	3	3
<b>Average</b>	<b>3.00</b>	<b>2.60</b>	<b>2.40</b>	<b>2.00</b>	<b>3.00</b>	-	-	<b>2.80</b>	<b>2.20</b>	<b>1.80</b>	<b>2.60</b>

  
CHAIRMAN  
BoS (CSE)

24AD601PE

**ROBOTIC PROCESS AUTOMATION**  
(COMMON TO AD AND EEE)

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

The student should be able to:

- Understand RPA fundamentals, including emerging trends like AI integration and hyperautomation
- Design efficient workflows using industry-standard tools with focus on process optimisation
- Apply automation in real-world domains including finance, healthcare, and manufacturing
- Manage exceptions, debugging, logging, and version control in enterprise-scale RPA projects
- Deploy and maintain bots with secure orchestration and compliance considerations

**UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9**

Emergence of RPA, Evolution, Differentiating RPA from automation, Benefits, Application areas, Components, AI-enhanced RPA, Hyperautomation, Templates, UI, Workflow files.

**UNIT II AUTOMATION PROCESS ACTIVITIES 9**

Sequence, Flowchart & Control Flow, Data Manipulation, File operations, UI controls, Advanced selectors, API integration, Handling events.

**UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9**

App integration, Recording mouse & keyboard actions, Web scraping, Process mining, OCR automation, Intelligent Document Processing.

**UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9**

Exception handling, Logging, Debugging, Error reporting, Version control, Automated bot testing, Project organization, Reusability, State machine.

**UNIT V DEPLOYMENT AND MAINTENANCE 9**

Publishing, Cloud-based orchestration, Control bots, License management, Updates, Compliance & governance, Open source RPA, Future of RPA.

**TOTAL PERIODS : 45**

  
**CHAIRMAN**  
**BoS (AD)**

## COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain RPA concepts, AI-enhanced RPA, and hyperautomation trends
- Develop workflows integrating advanced selectors and APIs
- Apply OCR and Intelligent Document Processing for automation tasks
- Implement exception handling, version control, and automated testing in RPA projects
- Deploy and manage bots using cloud orchestration with compliance and governance

## TEXT BOOKS

1. Alok Mani Tripathi, “Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with UiPath”, Packt Publishing, 2018.
2. Tom Tauli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress, 2020.
3. UiPath Academy, “Official UiPath RPA Developer Advanced Training”, UiPath Press, 2023.

## REFERENCE BOOKS

1. Frank Casale et al., “Introduction to Robotic Process Automation: A Primer”, Institute of RPA, 2018.
2. Richard Murdoch, “Robotic Process Automation: Guide to Building Software Robots”, Amazon Asia-Pacific, 2018.
3. Gartner, “RPA Market Trends Report”, 2023.
4. Deloitte, “RPA Compliance and Governance Framework”, 2022.

## Mapping of COs with POs:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	2	1	1	2	2	2
CO2	3	3	3	3	3	2	1	2	3	2	3
CO3	2	3	3	3	3	3	2	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

  
CHAIRMAN  
BoS (AD)

24ME106PE

**POWER PLANT ENGINEERING**  
(COMMON TO EEE AND MECH)

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Describe the components of coal-based thermal power plants and their functions.
- Understand the types and components of diesel, gas turbine, combined plants.
- Explain the fundamental concepts of nuclear engineering and nuclear power plants.
- Know the principles and applications of power generation from renewable energy sources.
- Compare the energy, economic, and environmental aspects of various power plants.

**UNIT I COAL BASED THERMAL POWER PLANTS 9**

Layout of modern coal power plant, super critical boilers, FBC boilers, coal handling, pulveriser, ash handling and types of draught – surface condenser types – cooling towers – feed water treatment - binary cycles – cogeneration system.

**UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9**

Diesel power plant: layout, components – Gas turbine power plant: open and closed cycles, gas turbine plant improvisation methods – Combined cycle power plants – Integrated gasifier based combined cycle systems.

**UNIT III NUCLEAR POWER PLANTS 9**

Basics of nuclear engineering, layout and subsystems of nuclear power plants, working of nuclear reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canada Deuterium - Uranium reactor (CANDU), breeder, gas cooled and liquid metal cooled reactors – safety measures for nuclear power plants.


**UNIT IV POWER FROM RENEWABLE ENERGY 9**

Hydroelectric power plants: typical layout and associated components – Principle, construction and working of wind, tidal, Solar Photo Voltaic (SPV), solar thermal, geo thermal, biogas and fuel cell power systems.

**UNIT V POWER PLANT SYSTEM ANALYSIS 9**

Power tariff types, load distribution parameters, load curve – comparison of site selection criteria – relative merits and demerits – capital and operating cost of different power plants – pollution control technologies including waste disposal options for coal and nuclear power plants.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
(BoS / MECH) 28/10/25

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Summarize the layout, construction and working of thermal power plant components.
- Relate the layout, construction and working of diesel, gas and combined plants.
- Demonstrate the nuclear power plant components and their operational layout.
- Illustrate the layout, construction and operation of renewable energy power plant components.
- Analyze the economics, environmental impacts and cost estimation of power plants.

**TEXT BOOKS:**

1. Rajput. R. K., “A Textbook of Power Plant Engineering”, 6<sup>th</sup> Edition, Laxmi Publications, 2023.
2. Nag. P.K., "Power Plant Engineering", 5<sup>th</sup> Edition, Tata McGraw – Hill Publishing Company Ltd., 2021.

**REFERENCES:**

1. Arora S C and Domkundwar S, “Power Plant Engineering”, 8<sup>th</sup> Edition, Dhanpat Rai and Sons, New Delhi, 2016.
2. Godfrey Boyle, “Renewable Energy”, 3<sup>rd</sup> Edition, Oxford University Press in association with the Open University, 2012.
3. El-Wakil. M.M., "Power Plant Technology", 1<sup>st</sup> Edition, Tata McGraw – Hill Publishing Company Ltd., 2010.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	-	2	-	-	-	-	2
CO2	2	1	1	-	-	2	-	-	-	-	2
CO3	3	1	1	-	-	2	-	-	-	-	2
CO4	3	1	1	-	-	2	-	-	-	-	2
CO5	3	2	1	-	-	2	-	-	-	-	2

  
 CHAIRMAN  
 (BoS / MECH)

**COURSE OBJECTIVES:**

The students should be made to:

- Describe the need, history, principles, and basic electrochemistry of fuel cells
- Summarize the main types of fuel cells and their relative advantages and disadvantages
- Explain the key components and performance characteristics of a fuel cell system
- Elucidate hydrogen storage and reformer technologies used for fueling fuel cells
- Discuss the main applications and economic aspects of fuel cell technology

**UNIT I OVERVIEW OF FUEL CELLS 9**

Overview of fuel cells – Need of fuel cell, History, Principle of fuel cell, Basic electrochemistry for all the fuel cells, Low and high temperature fuel cells – Thermodynamics and kinetics of fuel cell process – Performance evaluation of fuel cell – Comparison on battery versus fuel cell.

**UNIT II FUEL CELL TYPES 9**

Types of fuel cells: Alkaline Fuel Cell (AFC), Phosphoric Acid Fuel Cell (PAFC), Solid Oxide Fuel Cell (SOFC), Molten Carbonate Fuel Cell (MCFC), Direct Methanol Fuel Cell (DMFC) and Proton Exchange Membrane Fuel Cell (PEMFC) – Relative merits and demerits.

**UNIT III FUEL CELL COMPONENTS AND PERFORMANCE 9**

Fuel cell performance characteristics – Current/voltage, voltage efficiency and power density, Ohmic resistance, Butler–Volmer equation; Tafel equation, Kinetic performance, Mass transfer effects – Membrane electrode assembly components, Fuel cell stack, Bi–polar plate, Humidifiers and cooling plates.

**UNIT IV FUELING 9**

Hydrogen storage technology – Pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – Reformer technology: Steam reforming, partial oxidation and auto thermal reforming – CO removal – Fuel cell technology based on Bio–mass.

**UNIT V APPLICATION OF FUEL CELL AND ECONOMICS 9**

Fuel cell usage for domestic power systems, Large scale power generation, Automobile and space – Economic and environmental analysis on usage of hydrogen and fuel cell – Future trends in fuel cells.

**TOTAL: 45 PERIODS**

*PSP*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

## COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Distinguish the differences between low and high temperature fuel cells
- Compare the features, operating conditions, and applications of AFC, PAFC, SOFC, MCFC, DMFC and PEMFC fuel cells
- Analyze current-voltage relationships, efficiency and the role of components in fuel cell performance
- Identify different hydrogen storage methods and reforming processes and describe their impact on fuel cell operation
- Evaluate the use of fuel cells in domestic, industrial and transportation sectors

## TEXT BOOKS:

1. Dicks Andrew L and David A J Rand, "Fuel Cell Systems Explained", John Wiley and Sons, 2018.
2. Ryan O'Hayre, Suk-Won Cha, Whitney Colella and Fritz B Prinz, "Fuel Cell Fundamentals", Third Edition, Wiley, 2016.

## REFERENCES:

1. Frederick J Barclay, "Fuel Cells, Engines and Hydrogen", Wiley, 2009.
2. Bent Sorensen, Giuseppe Spazzafumo, "Hydrogen and Fuel Cells: Emerging Technologies and Applications", Third Edition, Elsevier, UK, 2018.
3. Jeremy Rifkin, "The Hydrogen Economy", Penguin Publishing Group, 2003.
4. Rebecca L Busby, "Hydrogen and Fuel Cells: A Comprehensive Guide", Penn Well Corporation, Oklahoma, 2005.
5. Viswanathan B and Aulice Scibioh M, "Fuel Cells: Principles and Applications", Universities Press, 2007.

## Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	1	-	-	-	-	2	3	2
CO2	3	3	3	2	-	2	-	-	-	-	2	3	2
CO3	3	3	3	2	-	2	-	-	-	-	2	3	2
CO4	3	3	3	3	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	-	-	-	-	-	-	2	3	2

  
CHAIRMAN  
BoS (EEE)

24EE602PE

**ENERGY CONSERVATION IN ELECTRICAL  
SYSTEMS**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Describe different types of energy, energy demand and the present and future energy scenario
- Explain energy management techniques and opportunities for energy conservation
- Illustrate the principles of material and energy balance in industrial facilities
- Summarize the process and importance of energy audits in industry
- Discuss the steps in energy action planning and the role of management in energy assessment

**UNIT I ENERGY AND ENERGY SCENARIO 9**

Introduction – Types of energy – Commercial and Non-commercial energy – Grades of energy – Energy demand – Energy scenario and security – Future energy strategy.

**UNIT II ENERGY MANAGEMENT AND CONSERVATION 9**

Energy management techniques – Tariff – Energy conservation opportunities – Fan systems – Energy efficient motors.

**UNIT III MATERIAL AND ENERGY BALANCE 9**

Principle – Material balance – Energy balance – Flow chart – Facility as an energy system – Balancing in energy and mass – Energy conservation measures.

**UNIT IV ENERGY AUDIT 9**

Introduction – Type of energy audit – Types of energy conservation measures – Plant Energy Performance (PEP) – Energy conservation act, 2001 and its features – Responsibilities and duties – Energy audit instruments: Electrical measuring instruments, Energy meter, Lux meters and Fuel efficiency monitor.

**UNIT V ENERGY ACTION PLANNING 9**

Energy management system – Support and commitment of the top management – Performance of energy assessment – Goals setting in an energy management organization – Process of evaluating progress – Monitoring and targeting.

**TOTAL: 45 PERIODS**

*PSP*  
**CHAIRMAN  
BoS (EEE) 16/10/25**

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Identify commercial and non-commercial energy sources and discuss strategies for future energy security
- Apply energy management methods and suggest ways to save energy in systems like fans and motors
- Analyse material and energy flows and recommend conservation measures
- Conduct a basic energy audit and use instruments to measure and improve plant energy performance.
- Develop an energy management plan, set goals and monitor progress in an organization

**TEXT BOOK:**


1. Anil Kumar, Om Prakash and Prashant Singh Chauhan, "Energy Management: Conservation and Audits", First Edition, CRC Press, 2020.

**REFERENCES:**

1. Stephen A Roosa, Steve Doty, Wayne C Turner, "Energy Management Hand book", Ninth Edition, River Publishers, 2018.
2. Dryden I G C, "The Efficient Use of Energy" Second Editon, Butterworth-Heinemann, 2013.
3. Murphy W R, "Energy Management", Elsevier Publishing Books Private Limited, 2003.
4. Parag Diwan and Prasoom Dwivedi, "Energy Conservation", First Edition, Pentagon Press, 2009.
5. Larry C Witte, Philip S Schmidt and David R Brown, "Industrial Energy Management and Utilisation" Hemisphere Publication Corporation, New York, 2023.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	3	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	2	3	2

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:****The students should be made to:**

- Explain the global energy context, different types of biomass resources and challenges in biomass conversion
- Understand various pretreatment techniques and conversion technologies
- Describe microbial and biological processes for biofuel production and biochar upgrading
- Analyze production methods, microorganisms and technologies involved in liquid and gaseous biofuels
- Evaluate value-added biomass products and integrated biorefinery concepts

**UNIT I INTRODUCTION TO BIOMASS AND BIOREFINERY 9**

World energy scenario, consumption patterns, fossil fuel depletion and environmental issues – Biomass: availability, abundance, photosynthesis, composition and energy potential – Virgin and waste biomass resources (municipal, industrial, agricultural, forestry) – Dedicated energy crops: annual crops (maize, sorghum, sugar beet, hemp), perennial herbaceous crops (sugarcane, switchgrass, miscanthus), short rotation woody crops (poplar, willow) and oil crops. Microalgae as feedstock for biofuels and biochemical production – Challenges in biomass conversion and enhancement of biomass properties.

**UNIT II PRETREATMENT AND CONVERSION TECHNOLOGIES 9**

Concept and types of biorefineries – Feedstock properties and techno-economic aspects – Barriers in lignocellulosic biomass conversion. Pretreatment technologies: acid, alkali, autohydrolysis and hybrid methods – Role of pretreatment in the biorefinery concept. Physical and thermal conversion processes: Fundamentals, equipment, products and applications.

**UNIT III BIOLOGICAL AND MICROBIAL CONVERSION 9**

Microbial conversion processes: Types, fundamentals, equipment and products – Biodiesel production: Diesel from vegetable oils, microalgae and syngas – Transesterification, Fischer-Tropsch (FT) process, Catalysts – Biodiesel purification and fuel properties – Bio-oil and biochar: production factors, upgrading and fuel properties.

**UNIT IV LIQUID AND GASEOUS BIOFUELS 9**

Bioethanol: Corn ethanol, lignocellulosic ethanol, Microorganisms for fermentation – Industrial ethanol technology, Cellulases in hydrolysis, SSF (Simultaneous Saccharification and Fermentation), CBP (Consolidated Bioprocessing) – Advanced fermentation technologies – Biobutanol: ABE (Acetone–Butanol–Ethanol) fermentation pathway, kinetics, product recovery technologies – Hydrogen: Metabolic basics, feedstocks, microbial dark fermentation (anaerobes, facultative, thermophiles) – Integration of biohydrogen with fuel cells – Methane and biogas technology: Fundamentals, fermenter design and purification – Methanol: Production and utilization.

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## UNIT V VALUE-ADDED PRODUCTS AND INTEGRATED BIOREFINERY 9

Biomass as feedstock for organic commodity chemicals: Lactic acid, Polylactic acid, Succinic acid, Propionic acid, Acetic acid, Butyric acid, 1,3-Propanediol, 2,3-Butanediol, PHAs – Integrated biorefinery concepts: Corn/soybean/sugarcane biorefineries, lignocellulosic biorefinery, aquaculture and algal biorefinery and waste biorefinery – Hybrid chemical and biological conversion processes – Techno-Economic Assessment (TEA) – Life-Cycle Assessment (LCA).

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Summarize the global energy scenario, various biomass resources and challenges in biomass conversion technologies
- Apply knowledge of different pretreatment methods and conversion technologies for biomass feedstocks
- Explain microbial and biological conversion mechanisms and assess biodiesel production and biochar upgrading techniques
- Examine the methods of production, the role of microorganisms and the technologies used for various biofuels
- Evaluate value-added products from biomass and the principles used in integrated biorefineries

### TEXT BOOKS:

1. Ashok Pandey, Tyagi R D and Sunita Varjani, “Biorefinery: Integrated Sustainable Processes for Biomass Conversion to Biofuels and Biochemicals”, Elsevier, 2021.
2. Donald L Klass, “Biomass for Renewable Energy, Fuels, and Chemicals”, Academic Press, Elsevier, 2006.

### REFERENCES:

1. Prabir Basu, “Biomass Gasification, Pyrolysis and Torrefaction”, Academic Press, Elsevier, 2013.
2. Vertes A A, Qureshi N, Blaschek H P and Yukawa H, “Biomass to Biofuels: Strategies for Global Industries”, Wiley, 2010.
3. S Yang H A El-Enshasy N and Thongchul, “Bioprocessing Technologies in Biorefinery for Sustainable Production of Fuels, Chemicals and Polymers”, Wiley, 2013.
4. Shang Tian Yang, “Bioprocessing for Value Added Products from Renewable Resources”, Elsevier, 2007.
5. De S, “Biofuels and Bioenergy: Processes and Technologies”, CRC Press, 2017.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	–	–	–	–	–	–	2	3	3
CO2	3	3	3	2	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	2	3	3

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Understand wind energy principles, wind behavior, atmospheric effects and instrument for wind measurement
- Explain airfoil aerodynamics, blade design theories, types of wind turbines and control mechanisms
- Summarize the role of sensors, grid synchronization, control systems and protection devices in gear coupled generator turbines
- Demonstrate operation and control of excited rotor synchronous and PMG generators
- Analyze pitch control systems, turbine protections and remote monitoring using SCADA

**UNIT I WIND ENERGY FUNDAMENTALS AND WIND MEASUREMENTS 6**  
 Wind energy basics – Wind speeds and scales – Terrain – Roughness – Wind mechanics – Power content – Class of wind turbines – Atmospheric boundary layers – Turbulence – Instrumentation for wind measurements.

**UNIT II AERODYNAMICS THEORY AND WIND TURBINE TYPES 6**  
 Airfoil terminology – Blade element theory – Blade design – Types of loads – Sources of loads – Constant speed constant frequency and variable speed variable frequency, Up wind, Down wind, Stall control, Pitch control, Gear coupled generator type and direct generator drive.

**UNIT III GEAR COUPLED GENERATOR WIND TURBINE COMPONENTS AND THEIR CONSTRUCTION 6**  
 Electronics sensors/encoder/resolvers – Wind measurement: Anemometer and wind vane, Grid synchronization system, Compensation panel, Programmable logic control, Yaw and pitch system – AC Drives, Differential protection relay for generator, Battery/Super capacitor charger.

**UNIT IV DIRECT ROTOR COUPLED GENERATOR 6**  
 Excited rotor synchronous generator / PMG generator, Control rectifier, Capacitor banks, Grid tied inverter, Power management and grid monitoring unit (Voltage and Current).

**UNIT V MODERN WIND TURBINE CONTROL AND MONITORING SYSTEM 6**  
 Details of pitch system and control algorithms – Protections used and safety consideration in wind turbines – Wind turbine monitoring with error codes – SCADA and databases: Remote monitoring and generation reports – Operation and maintenance for product life cycle.

**THEORY: 30 PERIODS**

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 BoS (EEE) 16/10/25

**LIST OF EXPERIMENTS:**

1. Terrain roughness and wind shear effect on power generation.
2. Simulation of wind speed distribution using Weibull model.
3. Power curve simulation of Stall-control vs Pitch-control turbines.
4. Aerodynamic analysis of upwind vs downwind turbines.
5. Simulation of Gearbox-coupled Induction generator with grid synchronization.
6. Simulation of Permanent Magnet Generator (PMG) wind turbine with rectifier.
7. Grid-Connected inverter simulation for direct-drive wind turbines.
8. Pitch control algorithm simulation under variable wind conditions.

**PRACTICAL: 30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Illustrate fundamental wind energy principles, atmospheric influences and the use of instruments for wind measurement
- Describe airfoil aerodynamics, blade design theories, various types of wind turbines and their control mechanisms
- Summarize the functions of sensors, grid synchronization, control systems and protection devices in gear coupled generator turbines
- Demonstrate the operation and control strategies of excited rotor synchronous and permanent magnet generators
- Evaluate pitch control systems, turbine protection methods and the application of SCADA for remote wind turbine monitoring

**TEXT BOOKS:**

1. Manwell J F, McGowan J G and Rogers A L, "Wind Energy Explained: Theory, Design and Application", Second Edition, Wiley, 2009.
2. Burton T, Sharpe D, Jenkins N and Bossanyi E, "Wind Energy Handbook", Second Edition Wiley, 2011.


**REFERENCES:**

1. Hau E, "Wind Turbines: Fundamentals, Technologies, Application, Economics", Third Edition, Springer, 2013.
2. Heier S, "Grid Integration of Wind Energy Conversion Systems", Third Edition, Wiley, 2014.
3. Earnest J and Wizelius T, "Wind Power Plants and Project Development", Printice Hall of India Learning, 2011.
4. Mukund R Patel and Omid Beik, "Wind and Solar Power Systems: Design, Analysis and Operation", Third Edition, CRC Press, 2025.

  
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**BoS (EEE)**

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	2	2	2	2	-	2	2	-	2	3	2
<b>CO2</b>	3	3	3	3	3	3	-	1	2	-	2	3	2
<b>CO3</b>	3	3	3	2	3	3	-	1	2	-	2	3	2
<b>CO4</b>	3	3	3	3	2	-	-	2	3	-	2	3	2
<b>CO5</b>	3	3	3	3	2	-	-	2	3	-	3	3	2

  
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24ME103PE

**ENERGY STORAGE DEVICES**  
(COMMON TO EEE AND MECH)

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the necessity, types, comparison, and applications of energy storage systems.
- Relate modelling approaches for the design and analysis of thermal storage systems using simulation tools like TRNSYS..
- Gain knowledge on battery performance and mathematical modelling techniques.
- Acquire knowledge of the principles and operations of various types of fuel cells.
- Explore the principles, and applications of advanced and hybrid energy storage technologies.

**UNIT I INTRODUCTION**

**7**

Necessity of energy storage – Types of energy storage – Comparison of energy storage technologies – Applications.

**UNIT II THERMAL STORAGE SYSTEM**

**10**

Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach, Use of TRNSYS..

**UNIT III ELECTRICAL ENERGY STORAGE**

**10**

Fundamental concept of batteries – measuring of battery performance, charging and discharging, power density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide, Li-ion batteries - Mathematical Modelling for Lead Acid Batteries – Flow Batteries.

**UNIT IV FUEL CELL**

**9**


Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantages and disadvantages.

**UNIT V ALTERNATE ENERGY STORAGE TECHNOLOGIES**

**9**

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
(BoS / MECH) 28/10/25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the need, types, and applications of energy storage technologies.
- Apply modelling techniques for designing and analyzing thermal storage systems using TRNSYS.
- Examine battery performance to develop models for lead-acid and flow batteries.
- Assess the working principles of various types of fuel cells.
- Develop the applications of advanced and hybrid energy storage systems.

**TEXT BOOKS:**

1. Robert A.huggins, 'Energy Storage', Fundamentals, Materials and Applications", Springer, 2<sup>nd</sup> Edition,2016
2. Ibrahim Dincer and Mark A. Rosen, 'Thermal Energy Storage Systems and Applications', John Wiley & Sons, 3<sup>rd</sup> Edition, 2021.

**REFERENCES:**

1. Ru-shi Liu, Lei Zhang and Xueliang sun, 'Electrochemical technologies for energy storage and conversion', Wiley publications, 2<sup>nd</sup> Volume set, 2012.
2. James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3<sup>rd</sup> Edition, 2018.
3. Lunardini.V.J, 'Heat Transfer in Cold Climates', John Wiley and Sons 1981, 1<sup>st</sup> Edition.
4. Schmidt.F.W. and Willmott.A.J., 'Thermal Energy Storage and Regeneration', Hemisphere Publishing Corporation, 1981, 1<sup>st</sup> Edition.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	-	2	-	-	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-
CO4	3	3	2	-	-	1	-	-	-	-	-
CO5	3	2	2	2	-	2	-	-	-	-	-

CHAIRMAN  
(BoS / MECH)

**COURSE OBJECTIVES:**

The students should be made to:

- Understand fundamental principles of electric drives and control methods for traction motor drives
- Explain the basic concepts and terminology of illumination engineering
- Describe different methods and technologies used in electric heating and welding
- Summarize refrigeration and air conditioning concepts, system types, refrigerants and load estimation
- Analyze the economic factors influencing electrical energy utilization and energy management for conservation

**UNIT I ELECTRIC DRIVES AND TRACTION 9**

Fundamentals of electric drive – Choice of an electric motor – Application of motors for particular services. Traction motors – Characteristic features of traction motor – Systems of railway electrification – Electric braking – Train movement and energy consumption – Traction motor control – Track equipment and collection gear.

**UNIT II ILLUMINATION 9**

Introduction – Definition and meaning of terms used in illumination Engineering – Classification of light sources: Incandescent lamps, sodium vapour lamps, mercury vapour lamps and fluorescent lamps – Design of illumination systems – Indoor lighting schemes – Factory lighting halls – Outdoor lighting schemes – Flood lighting – Street lighting – Energy saving lamps.

**UNIT III HEATING AND WELDING 9**

Introduction – Advantages of Electric heating – Modes of heat transfer – Methods of electric heating – Resistance heating – Arc furnaces – Induction heating – Dielectric heating. Electric welding – Types – Resistance welding – Arc welding – Radiation welding – Requirements of good weld – Preparation of work – Electrodes – Power supply for arc welding.

**UNIT IV REFRIGERATION AND AIR CONDITIONING 9**

Introduction – Refrigeration cycle – Refrigeration system – Types of refrigerants – Domestic refrigerator – Water coolers – Air conditioning systems – Air conditioning cycle – Classification of air conditioning systems – Central systems – Unitary systems – Load estimation – Heating of building.

**UNIT V ECONOMICS OF ELECTRICAL ENERGY UTILIZATION 9**

Economics of electric power supply – General rule for charging the energy – Economical cross section of a conductor – Ratings of a motor – Temperature rise in a motor – Power factor improvement – Methods of reducing power factor occurrence – Economic choice of equipment – Energy management – Energy auditing – Power quality – Effect on conservation.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Demonstrate knowledge of fundamental electric drive principles and control methods for traction motor drives
- Recognize the concepts and terminology in illumination engineering and different lighting systems
- Illustrate various electric heating and welding methods, technologies and quality requirements
- Summarize refrigeration and air conditioning principles, system classifications, refrigerants and load estimation techniques
- Evaluate economic factors in electrical energy utilization and implement energy management strategies for conservation

**TEXT BOOKS:**

1. Suryanarayana N V, “Utilisation of Electric Power: Including Electric Drives and Electric Traction”, Reprint, New Age Publishers, 2017.
2. Gupta J B, “Utilization of Electric Power and Electric Traction”, S K Kataria and Sons, 2012.

**REFERENCES:**

1. Rajput R K, “Utilisation of Electric Power”, Laxmi Publications Private Limited, 2007.
2. Partab H, “Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Company, New Delhi, 2004.
3. Kothari P, Singal K C and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, Printice Hall of India Private Limited, New Delhi, 2008.
4. Rai G D, “Non-Conventional Energy Sources”, Khanna Publications Limited, New Delhi, 1997.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	–	–	–	–	–	–	–	2	3	2
<b>CO2</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2	3	2
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	3	3	2

*PSP*  
**CHAIRMAN**  
**BoS (EEE)**

24EE606PE

**SOLAR ENERGY ENGINEERING AND  
TECHNOLOGY**  
(Common to AGE, EEE and Mech)

L T P C

3 0 0 3

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the principles of solar energy conversion and methods for measuring and estimating solar radiation under various climatic conditions.
- Design standalone and grid-connected photovoltaic systems.
- Analyze the components and semiconductor physics of grid-connected PV systems,
- Evaluate the fundamentals, performance, testing and applications of solar air heaters and concentrating solar collectors
- Describe different thermal energy storage techniques and solar energy applications

**UNIT I INTRODUCTION 9**

Energy scenarios – Overview of solar energy conversion devices and applications – Physics of propagation of solar radiation from the sun to the earth – Sun earth geometry, Extra-terrestrial and terrestrial radiation – Solar energy measuring instruments – Geometry, angles and measurement – Estimation of radiation under different climatic conditions – Estimation of total radiation.

**UNIT II PHOTOVOLTAIC SYSTEMS 9**

Semiconductor physics – Fundamentals of solar PV cells – Performance characterization of PV cells – Photovoltaic modules and arrays – Components of standalone PV system – Design of standalone PV system – Functioning and components of PV system – Design of a grid connected PV system – Performance analysis of a grid connected PV system.

**UNIT III GRID CONNECTED PV SYSTEMS 9**

Schematics semiconductor physics – Component semiconductor physics – Charge conditioners semiconductor physics – Interface components – Balance of system components – PV system in buildings.

**UNIT IV SOLAR AIR HEATERS AND CONCENTRATIC COLLECTOR 9**

Basics and performance analysis of solar air heaters – Testing and application of solar air heaters – Fundamentals of concentrating collectors – Concentrating collector technologies and working principle – Concentrating collector.

**UNIT V THERMAL ENERGY STORAGE AND APPLICATIONS 9**

Sensible heat, latent heat and thermo-chemical energy storage – Solar pond – Solar pond power plant design – Emerging technologies – Solar energy applications in cooking, desalination, refrigeration and electricity generation – Tutorial: COP of VARS and performance analysis of PVT collector.

**TOTAL: 45 PERIODS**

*P. S. Prasad*  
**CHAIRMAN**  
BoS (EEE) 16/10/25

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain solar radiation fundamentals, sun–earth geometry and measurement techniques
- Construct standalone and grid-connected photovoltaic systems based on design principles and application requirements
- Examine the semiconductor physics and components of grid-connected PV systems
- Assess the operation, performance, testing procedures and applications of solar air heaters and concentrating solar collectors
- Design basic layouts of solar pond power plant considering thermal energy extraction and conversion

**TEXT BOOK:**


1. Tiwari G N, “Solar Energy, Fundamentals, Design, Modeling and Applications”, Narosa, 2013.

**REFERENCES:**

1. Sukhatme S P and Nayak J K, “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill, 2006.
2. Duffie J A and Beckman W A, “Solar Engineering of Thermal Processes”, John Wiley, 2006.
3. Yogi Goswami D, Kreith Frank and Jan F Kreider, “Principles of Solar Engineering”, Taylor and Francis, 2000.
4. Green M A, “Third Generation Photovoltaics: Advanced Solar Energy Conversion”, Springer, 2003.
5. Goetzberger A and Hoffmann V U, “Photovoltaic Solar Energy Generation”, Springer Verlag, 2010.

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	2	–	–	–	–	–	–	2
<b>CO2</b>	3	3	3	2	–	2	–	–	–	–	2
<b>CO3</b>	3	3	3	2	–	2	–	–	–	–	2
<b>CO4</b>	3	3	3	3	–	–	–	–	–	–	2
<b>CO5</b>	3	3	3	3	–	2	–	–	–	–	2

  
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**BoS (EEE)**



### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand neural network models for solving basic pattern recognition problems
- Implement a simple genetic algorithm to address an engineering optimization task
- Design a fuzzy rule-based system for a real-world classification or control problem
- Apply a swarm intelligence technique to solve a clustering or scheduling problem
- Select appropriate soft computing techniques to solve a real-world problem

### TEXT BOOKS:

1. Rajsekaran S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India, 2020.
2. Bijaya Ketan Panigrahi, Yuhui Shi and Meng-Hiot Lim, "Handbook of Swarm Intelligence: Concepts, Principles and Applications", Springer, 2013.

### REFERENCES:

1. Miller W T, Sutton R S and Webrose P J, "Neural Networks for Control", MIT Press, 1996.
2. Timothy J Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2020.
3. George J Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Pearson Education India, 2020.
4. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw Hill, 2017.
5. David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 2009.

### Mapping of COs with POs:

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CO1	3	2	2	1	-	-	-	-	-	-	2
CO2	3	3	3	2	-	-	-	-	-	-	2
CO3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	-	-	-	-	-	-	2

*PSP Books*  
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BoS (EEE)

24EE702PE

**INDUSTRIAL AUTOMATION AND MODERN  
CONTROL SYSTEMS**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Explain the need, types, and main components of industrial automation systems
- Summarize the functional architecture and integration features of ABB System 800xA
- Illustrate the use of Docker containers for deploying and managing industrial automation applications
- Describe the features of Allen Bradley ControlLogix L84E and the basics of structured text programming
- Discuss the integration of ABB System 800xA, Docker and Allen Bradley PLCs for real-time industrial automation

**UNIT I FUNDAMENTALS OF INDUSTRIAL AUTOMATION 9**

Introduction to automation: Need, scope, and benefits. Types of automation: Fixed, programmable and flexible – Components of automation systems: Sensors, actuators, controllers – PLCs and SCADA overview – Industrial communication protocols (Modbus, Profibus).

**UNIT II ABB SYSTEM 800XA ARCHITECTURE AND ENGINEERING 9**

Overview of ABB System 800Xa – Functional architecture and integration – Engineering studio and function designer – Control strategies and HMI configuration. Case studies in process industries.

**UNIT III DOCKER CONTAINERS IN INDUSTRIAL APPLICATIONS 9**

Introduction to containerization – Docker architecture and components – Creating and managing containers – Docker in automation and IoT – Integration with SCADA and cloud platforms.


**UNIT IV ALLEN BRADLEY CONTROL LOGIX L84E AND STRUCTURED TEXT PROGRAMMING 9**

Overview of Allen Bradley ControlLogix L84E – RSLogix 5000/Studio 5000 environment – Structured Text (ST) language syntax and semantics – Programming examples: Timers, counters and PID – Troubleshooting and diagnostics.

**UNIT V INTEGRATION AND CASE STUDIES 9**

Integrating ABB System 800xA with Docker and Allen Bradley PLCs – Real-time monitoring and control – Cybersecurity in industrial automation – Case studies: Smart manufacturing, energy systems – Future trends: Edge computing and AI in automation.

**TOTAL: 45 PERIODS**

  
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BoS (EEE) 16/10/25**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the roles of sensors, actuators, controllers, PLCs and SCADA in automation
- Analyse the ways ABB System 800xA supports process automation through its engineering tools and integration capabilities
- Demonstrate the creation and management of Docker containers for automation and IoT integration
- Develop and troubleshoot simple automation programs using Structured Text in the Studio 5000 environment
- Evaluate real-world case studies to propose integrated automation solutions with attention to cybersecurity and future trends

### TEXT BOOK:

1. Frank Lamb, "Industrial Automation Hands-On" Illustrated Edition, McGraw-Hill Education, 2013.

### REFERENCES:

1. Rockwell Automation, "Allen Bradley ControlLogix System User Manual", Rockwell Publications, 2021.
2. Hans Berger, "Automating with SIMATIC S7-1500: Configuring, Programming and Testing with Step 7 Professional", Second Edition, Publicis McD Werbeagentur, 2017.
3. ABB Group, System 800xA Architecture and Engineering Manual, ABB Publications, 2020.
4. Mikell P Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Fourth Edition, Pearson Education, 2016.
5. Jon Stenerson, "Fundamentals of Programmable Logic Controllers, Sensors and Communications", Third Edition, Pearson, 2004.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	–	1	–	–	–	–	2	3	2
<b>CO2</b>	3	3	3	2	–	2	–	–	–	–	2	3	2
<b>CO3</b>	3	3	3	2	–	2	–	–	–	–	2	3	3
<b>CO4</b>	3	3	3	3	–	–	–	–	–	–	2	3	3
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	2	3	3

  
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BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Explain the basic structure, programming languages and safety features of PLC systems
- Describe the main elements and programming standards defined by IEC 61131-3 for PLCs
- Summarize the types of process control systems and industrial communication networks
- Illustrate the process of designing wiring diagrams and converting relay schematics into PLC ladder logic programs
- Discuss the elements and functions of SCADA systems in industrial automation

**UNIT I INTRODUCTION 9**

Programmable Logic Controller (PLC) – Block diagram of PLC – Programming languages of PLC – Basic instruction sets – Design of alarm and interlocks – Networking of PLC – Overview of safety of PLC with case studies.

**UNIT II IEC 61131-3 9**

Rails – Rungs – Relay Logic – Latch switch – Timers – Counters – Boolean logics – Math instructions – Data manipulation instructions – Requirement of communication networks for PLC; PLC to PC communication to computer – FBD equivalent to LL – FBD programming – Instruction List (IL), Sequential Function Chart (SFC), Structured Text (ST).

**UNIT III PROCESS CONTROL AND NETWORK SYSTEMS 9**

Types of processes – Structure of control systems – ON/OFF control – PID control – Motion control – Data communications: Data highway, Serial communication, DeviceNet, ControlNet, EtherNet/IP, Modbus, Fieldbus, PROFIBUS-DP – Introduction about Highway Addressable Remote Transducer (HART) and Field Bus.

**UNIT IV DEVELOPING FUNDAMENTAL PLC WIRING DIAGRAMS AND LADDER LOGIC PROGRAMS 9**

Electromagnetic control relays – Contactors – Motor starters – Manually operated switches – Mechanically operated switches – Sensors: Proximity sensor, Magnetic reed switch, Light sensors, Ultrasonic sensors, Strain/Weight sensors, Temperature sensors, Flow measurement, Velocity and position sensors – Output control devices – Seal-n circuits – Electrical interlocking circuits – Latching relays – Converting relay schematics into PLC Ladder programs – Writing a Ladder logic program directly from a narrative description.

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CHAIRMAN 16/10/25  
BoS (EEE)

**UNIT V SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) 9**

Elements of SCADA system – History of SCADA, Remote Terminal Unit (RTU) – Discrete control – Analog control – Master Terminal Unit (MTU) – Operator interface.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Identify key components and programming methods of PLCs and explain their role in industrial safety
- Develop simple PLC programs using Ladder logic, Function block diagram and structured text
- Select appropriate control strategies and communication protocols for various industrial processes
- Create and troubleshoot basic ladder logic programs for automation tasks using sensor and actuator inputs
- Elucidate the operation of SCADA systems and explain their importance in remote monitoring and control

**TEXT BOOKS:**

1. Frank D Petruzella, “Programmable Logic Controllers”, Fifth Edition, McGraw- Hill, New York, 2019.
2. Stuart Boyer A, “SCADA: Supervisory Control and Data Acquisition”, Fourth Edition, ISA- The Instrumentation, Systems and Automation Society, 2010.


**REFERENCES:**

1. Bolton W, “Programmable Logic Controllers”, Sixth Edition, Elsevier Newnes, 2015.
2. Mano, M Morris, “Digital Logic and Computer Design”, Pearson Education India, 2017.
3. Kamel, Khaled and Eman Kamel, “Programmable Logic Controllers: Industrial Control”, McGraw Hill Professional, 2013.
4. “PLC Handbook - Practical Guide to Programmable Logic Controllers”, Automation Direct. com.
5. Jack and Hugh. “Automating Manufacturing Systems with PLCs”, Lulu. com, 2010.
6. CHUNGPA, “User’s Manual: Universal PLC Training System CPS-3580U”, English Version I, 2020.
7. Egyptian Company for the Development of Technical Education (ECDTE), PLC Kit Manual: ECDTE 1000.1 Laboratory Manual, 2018.

  
**CHAIRMAN  
BoS (EEE)**

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	2	2	-	-	-	-	2	3	2
<b>CO2</b>	3	3	3	2	2	2	-	-	-	-	2	3	3
<b>CO3</b>	3	3	3	2	3	2	-	-	-	-	2	3	3
<b>CO4</b>	3	3	3	2	-	-	-	-	-	-	2	3	3
<b>CO5</b>	3	3	3	2	-	-	-	-	-	-	3	3	3

  
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BoS (EEE)

24EC502

**DIGITAL SIGNAL PROCESSING  
(COMMON TO ECE AND EEE)**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

The student should be made to:

- Understand the principles of DFT and FFT for analyzing discrete-time signals.
- Apply various methods to design FIR and IIR filters using filter approximations.
- Analyze the effects of finite word length and quantization on the performance of digital systems.
- Explain DSP processor architectures including instruction sets and addressing modes.
- Study the digital signal processing techniques to analyze, process and enhance real-world applications.

**UNIT I DFT AND FFT**

9

Basic Elements of DSP – Introduction to DFT - Computation of DFT and IDFT - Properties of DFT - Circular Convolution - Fast Fourier Transform(FFT) - Radix-2 FFT Algorithms: Decimation in Time and Decimation in Frequency FFT algorithms.

**UNIT II FIR AND IIR DIGITAL FILTERS**

9

FIR Filters: Magnitude and Phase response of digital filters- Design of Linear Phase FIR filters- Fourier Series method - Windowing technique(Rectangular, Hamming and Hanning window)- Gibbs Phenomenon- FIR Filter Structures: Direct form, Cascade form, Linear Phase realization.  
IIR Filters: Design of digital IIR filters from analog filters- Bilinear Transformation-Impulse Invariance method– Design of digital lowpass Butterworth Filter - Comparison of FIR and IIR filters.

**UNIT III FINITE WORD LENGTH EFFECTS**

9

Fixed Point and Floating Point Number Representation – Quantization Noise – Derivation for Quantization Noise Power - Truncation and Rounding – Input Quantization Error – Coefficient Quantization Error - Product Quantization Error – Limit Cycle Oscillations – Dead band

**UNIT IV DIGITAL SIGNAL PROCESSORS**

9

Introduction to Digital Signal Processors - Von Neumann architecture, Harvard architecture – VLIW architecture – MAC Unit - Pipelining – Architecture of TMS320C5x Digital Signal Processor- Instruction Set – Addressing Modes - Architecture of TMS320C67x Digital Signal Processor.

**UNIT V APPLICATIONS OF DSP**

9

Channel Vocoder - Sub band coding of speech signals- Fetal ECG monitoring – Digital Hearing Aid - Ultrasound Imaging System - Adaptive Noise Cancellation - Adaptive Telephone Echo Cancellation – RADAR system.

**TOTAL: 45 PERIODS**

*M. Shree*  
CHAIRMAN  
BoS (ECE)

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply DFT and FFT techniques for discrete-time signal analysis in the frequency domain.
- Design and implement FIR and IIR digital filters using various methods and realize its structures.
- Analyze the impact of finite word length and quantization effects on the performance of DSP systems.
- Illustrate the architecture, functional units and operation of DSP processors such as TMS320C5X and TMS320C6748.
- Examine real-world applications of DSP techniques in areas such as speech processing, biomedical and communication systems.

## TEXT BOOK:

1. S Salivahanan, A Vallavaraj, C Gnanapriya, "Digital Signal Processing", Second Edition, Tata McGraw Hill, 2016.

## REFERENCES:

1. John G Proakis and Dimitris G Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Fourth edition, Pearson Education, 2017.
2. Sanjit K Mitra, "Digital Signal Processing-A Computer Based Approach", McGraw Hill Education, 2013.
3. B Venkataramani and M Bhaskar, "Digital Signal Processors, Architecture, Programming" Tata McGraw Hill 2002.
4. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Prentice Hall, 2013.
5. Nagoor Kani, "Digital Signal Processing", 2nd Edition, McGraw-Hill, New Delhi, 2017.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	3	-	-	-	-	-	2
CO2	3	3	2	2	3	-	-	-	-	-	2
CO3	3	3	2	2	3	-	-	-	-	-	2
CO4	2	1	1	-	2	-	-	-	-	-	2
CO5	2	1	1	-	2	2	-	-	-	-	3

  
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BoS (ECE)

24EE704PE

**INTELLECTUAL PROPERTY RIGHTS**  
(Common to ECE and EEE)

**L T P C**  
**3 0 0 3**


**COURSE OBJECTIVES:**

The students should be made to:

- Explain the basic concepts, types and importance of Intellectual Property Rights (IPR)
- Describe the procedures and practical aspects of registering various intellectual property rights in India and abroad
- Summarize major international treaties, conventions and national legislations related to intellectual property rights
- Discuss the impact of digital innovations on intellectual property laws and the challenges of protecting digital content
- Examine the enforcement mechanisms, remedies and emerging challenges in protecting intellectual property rights

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Introduction to Intellectual Property Rights (IPR) – Basic concepts and importance of Intellectual Property – Patents, Copyrights, Trademarks, Geographical Indications and Industrial Designs – Intellectual Property Rights in India and abroad – Genesis and development – World Trade Organization (WTO), World Intellectual Property Organization (WIPO) and Trade-related aspects of Intellectual Property Rights (TRIPS) framework – Nature of Intellectual Property – Industrial property – Research, Inventions and Innovations – Illustrative examples of IPR.		
<b>UNIT II</b>	<b>REGISTRATION OF IPR</b>	<b>9</b>
Practical aspects and procedures of registration – Copyrights – Trademarks – Patents – Geographical Indications – Trade secrets – Industrial Design registration in India and abroad.		
<b>UNIT III</b>	<b>AGREEMENTS AND LEGISLATIONS</b>	<b>9</b>
International treaties and conventions on IPRs – TRIPS agreement – Patent Cooperation Treaty (PCT) – The Patent Act of India and Amendment acts – Design act – Trademark act – Geographical Indications of Goods (Registration and Protection) act.		
<b>UNIT IV</b>	<b>DIGITAL PRODUCTS AND LAW</b>	<b>9</b>
Digital innovations and knowledge assets – Intellectual property laws in the digital era – Cyber Law and digital content protection – Unfair competition – Concept, scope and relationship with IPR laws – Case studies.		
<b>UNIT V</b>	<b>ENFORCEMENT OF IPRs</b>	<b>9</b>
Infringement of IPR – Enforcement measures and remedies – Emerging issues and challenges in IPR enforcement – Case studies.		

**TOTAL: 45 PERIODS**

  
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BoS (EEE) 16/10/25  
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## COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify different forms of intellectual property and describe their significance in research, innovation and industry
- Demonstrate the steps involved in registering copyrights, trademarks, patents, geographical indications, trade secrets and industrial designs
- Interpret the relevance of TRIPS, WIPO, PCT and Indian IPR laws in protecting and managing intellectual property
- Analyse case studies to evaluate the effectiveness of IPR and cyber laws in the digital era
- Assess infringement cases and propose suitable enforcement measures for effective IPR protection

## TEXT BOOKS:

1. Deborah E Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Fourth Edition, Cengage Learning, 2016.
2. Scople Vinod V, "Managing Intellectual Property", Prentice Hall of India Private Limited, 2012.

## REFERENCES:

1. Narayanan P, "Intellectual Property Law", Eastern Law House, 2017.
2. Deborah E Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Third Edition, Cengage Learning, 2012.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
4. Edited by Derek Bosworth and Elizabeth Webster, "The Management of Intellectual Property", Edward Elgar Publishing Limited, 2013.
5. WIPO Intellectual Property Handbook, World Intellectual Property Organization, 2017.
6. Satakar S V, "Intellectual Property Rights and Copy Rights", ESS ESS Publications, New Delhi, 2003.

## Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	2	–	–	2	–	2
CO2	3	3	2	–	–	3	–	–	2	–	2
CO3	3	3	2	–	–	3	–	–	2	–	2
CO4	3	3	2	–	–	–	–	–	2	–	2
CO5	3	3	2	–	–	–	–	–	2	–	2

  
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BoS (EEE)

**COURSE OBJECTIVES:****The students should be made to:**

- Identify the main parts and types of a power distribution system
- Find voltage drop and power loss in a distribution network
- Check the reliability and power quality of a distribution system
- Conduct a load flow study and improve reactive power in a network
- Use distributed generation and smart grid features in a distribution system

**UNIT I INTRODUCTION 9**

Overview of modern power distribution systems – Components and layout of distribution systems – Classification of distribution networks (radial, ring, interconnected) – Load characteristics and types of loads – Static and dynamic load modelling – Composite load modelling and load estimation techniques.

**UNIT II DISTRIBUTION SYSTEM CHARACTERISTICS AND PERFORMANCE 9**

Basic features of distribution systems – Voltage drop and power loss calculations – Feeder configurations and voltage regulation – Distribution transformers and substations – Network representation and equivalent circuits – Power factor improvement and voltage profile enhancement.

**UNIT III RELIABILITY AND POWER QUALITY ASSESSMENT 9**

Reliability indices for distribution systems – System average interruption frequency, duration and other metrics – Reliability evaluation methods: Series, parallel and network reduction – Reliability improvement techniques – Power quality problems: Voltage sag, swell, flicker, harmonics and interruptions – Monitoring and mitigation techniques for power quality.

**UNIT IV LOAD FLOW, REACTIVE POWER COMPENSATION AND PLANNING 9**

Distribution load flow analysis: Backward/forward sweep, Newton–Raphson and other methods – Reactive power management and capacitor placement techniques – Conventional reactive power compensation methods – Distribution system planning: Objectives, constraints and approaches – Network reconfiguration for loss reduction and reliability improvement.

*P. S. Prasad*  
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16/10/25

**UNIT V      DISTRIBUTED GENERATION, AUTOMATION AND SMART DISTRIBUTION SYSTEMS      9**

Integration of Distributed Generation (DG) in distribution systems – Modeling of DG units (solar-PV, wind, fuel cells and microturbines) – Energy storage systems and their modeling – Impact of DG on voltage profile, losses and reliability – Active distribution networks and automation – Smart grid features and communication infrastructure in distribution networks.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- List the parts and types of distribution systems and basic load models
- Calculate voltage drop, power loss and suggest ways to improve voltage and power factor
- Measure reliability and spot power quality problems in a system
- Perform load flow analysis and suggest ways to manage reactive power
- Show the effects of distributed generation and smart grid on system performance

**TEXT BOOKS:**

1. Gonen T, “Electric Power Distribution System Engineering”, Third Edition, CRC Press, 2014.
2. Lee Willis H, “Power Distribution Planning Reference Book”, Second Edition, Revised and Expanded, CRC press, 2004.

**REFERENCES:**

1. Pabla A S, “Electric Power Distribution”, Fifth Edition, Tata Mcgraw-Hill Publishing Company Limited, 2007.
2. Math Bollen and Fainan Hassan, “Integration of Distributed Generation in the Power System”, IEEE Press, 2011.
3. Roy Billinton R and Ronald N Allan, “Reliability Evaluation of Power Systems”, Second Edition, Springer, Berlin, 1996.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	-	-	-	-	-	-	2	3	2
CO5	3	3	2	3	-	-	-	-	-	-	2	3	2

*PSP Books*  
**CHAIRMAN**  
**BoS (EEE)**

24EE706PE	ENERGY CONSERVATION AND WASTE HEAT RECOVERY	L	T	P	C
		3	0	0	3

**COURSE OBJECTIVES:**

The students should be made to:

- Explain the importance of waste heat recovery and the basic laws of thermodynamics
- Describe common power plant cycles and the concept of energy cascading
- Illustrate the use of heat exchangers and their role in low temperature waste heat recovery
- Summarize advanced waste heat recovery technologies and direct conversion methods
- Discuss different energy storage methods and the economics of waste heat recovery

**UNIT I FUNDAMENTALS OF WASTE HEAT RECOVERY AND THERMODYNAMICS 9**

Introduction to Waste Heat and its importance – Waste Heat Recovery: Scope and benefits. Review of Thermodynamics: First and second laws, Entropy and entropy generation, First and second law efficiency.

**UNIT II POWER PLANT CYCLES AND ENERGY CASCADING 9**

Energy cascading in power plants – Rankine cycle and its modifications – Gas turbine cycle – Combined cycle systems (Gas turbine–Steam turbine) – Heat Recovery Steam Generators (HRSG).

**UNIT III HEAT EXCHANGERS AND LOW TEMPERATURE APPLICATIONS 9**

Thermodynamic cycles for low temperature applications – Cogeneration concepts – Introduction to heat exchangers – Analysis methods: LMTD and  $\epsilon$ -NTU – Problem solving in heat exchanger design – Special heat exchangers for waste heat recovery – Synthesis of heat exchanger networks.

**UNIT IV DIRECT CONVERSION AND ADVANCED WASTE HEAT TECHNOLOGIES 9**

Heat pipes and Vapor chambers – Direct conversion technologies: Thermoelectric generators, Thermoionic conversion, Thermo-photovoltaic (Thermo-PV) systems and Magneto Hydrodynamic (MHD) conversion.

**UNIT V ENERGY STORAGE AND ECONOMICS 9**

Heat Recovery from incinerators – Energy storage concepts – Storage techniques: Pumped hydro, Compressed air, Flywheel, Superconducting Magnetic Energy Storage (SMES), Thermal storage (Sensible and Latent), Batteries, Chemical storage and Fuel cells – Energy economics.

**TOTAL: 45 PERIODS**

*R. S. Rao*  
CHAIRMAN  
BoS (EEE) 16/10/25

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to,

- Identify benefits of waste heat recovery and use thermodynamics laws in simple systems
- Compare different power plant cycles and show that energy cascading increases efficiency
- Analyse heat exchanger problems and suggest designs for waste heat recovery
- Explain the working principles of heat pipes, thermoelectric generators and MHD systems
- Select energy storage methods and check the economic benefits of waste heat recovery

**TEXT BOOK:**

1. Hussam Jouhara, “Waste Heat Recovery in Process Industries”, Wiley, 2022.

**REFERENCES:**

1. John H Lienhard, “A Heat Transfer Textbook”, Fifth Edition, Dover Publications, 2019.
2. Herbert B Callen, “Thermodynamics and an Introduction to Thermostatistics”, First Edition, Wiley, 2006.
3. Mukesh Kumar Awasthi, Ashwani Kumar, Nitesh Dutt and Sivasakthivel Thangavel, “Heat Exchanger Technologies for Sustainable Renewable Energy Systems”, First Edition, CRC Press, 2025.
4. Kothandaraman C P, “Fundamentals of Heat and Mass Transfer”, Revised Edition, New Age International Private Limited, 2012.
5. Nag P K, “Engineering Thermodynamics”, Sixth Edition, Tata McGraw Hill, 2017.

**Mapping of COs with POs and PSOs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2	2	1	–	1	–	–	–	–	1	2	2
<b>CO2</b>	3	3	3	2	–	2	–	–	–	–	1	2	2
<b>CO3</b>	3	3	3	2	–	2	–	–	–	–	1	2	2
<b>CO4</b>	3	3	3	3	–	–	–	–	–	–	1	2	2
<b>CO5</b>	3	3	3	3	–	–	–	–	–	–	2	2	2

  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Identify the main hazards of electricity, such as shock and arc flash
- Study electrical safety equipment, including inspection, testing and use for protection
- Explain why electrical maintenance is important for safety and describe basic maintenance steps
- Summarize key electrical safety standards and rules from major organizations
- Describe the structure of a safety program and the importance of training and audits

**UNIT I HAZARDS OF ELECTRICITY** 9

Introduction – Hazard analysis – Shock: Description – Influencing factors. Arc: Definition and description of arc energy release, Arc energy, Arc energy input, Arcing voltage, Arc surface area, Incident energy, Arc burns and blast. Affected body parts: General, Skin, Nervous system, Muscular system, Heart, Pulmonary system. Summary of causes: Injury and death, Shock effect, Arc flash effect, Causes of Injury and causes of death. Protective strategies – Electromagnetism – Electrical properties of materials – Physical considerations in Electrical fault conditions.

**UNIT II ELECTRICAL SAFETY EQUIPMENT** 9

Introduction – General inspection and testing requirements for Electrical safety equipment – Arc-Flash and thermal protection – Head and eye protection – Rubber insulating equipment – Hot sticks – Insulated tools – Barriers and signs – Safety tags, Locks and Locking devices – Voltage-measuring instruments – Safety grounding equipment – Ground-Fault circuit interrupters – Arc-Fault circuit interrupters – Safety electrical One-line diagram – The Electrician's safety kit.

**UNIT III ELECTRICAL MAINTENANCE AND ITS RELATIONSHIP TO SAFETY** 9

Introduction – The Safety-related case for Electrical maintenance – The economic case for Electrical maintenance – Reliability-Centered Maintenance (RCM) – The Eight-step maintenance program – Frequency of maintenance – Condition-Based Maintenance (CBM) – Maintenance requirements for specific equipment and locations – Electrical safety by design.

**UNIT IV REGULATORY AND LEGAL SAFETY REQUIREMENTS AND STANDARDS** 9

Introduction – The regulatory bodies – The National Electrical Safety Code (NESC) – IEEE C-2 – The National Electrical Code (NEC)-NFPA 70 – Electrical equipment maintenance –NFPA 70B – Standard for Electrical safety in the workplace – NFPA 70E – American society for Testing and materials (ASTM) standards – Occupational Safety and Health Administration (OSHA) standards.

*R. S. Prasad*  
CHAIRMAN  
BoS (EEE) 16/10/25  
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## UNIT V SAFETY MANAGEMENT AND ORGANIZATIONAL STRUCTURE 9

Introduction – Changing the Safety Culture – Electrical Safety Program Structure – Electrical Safety Program Development – Employee Electrical Safety Teams – Safety Meetings – Outage Reports – Safety Audits – Safety Training Definitions – Comparison of the Four Most Commonly Used Methods of Adult Training – Elements of a Good Training Program – On-the-Job Training.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Illustrate hazards of electricity and describe their effects on the human body
- Select and use appropriate electrical safety equipment for different electrical tasks
- Apply maintenance practices to improve electrical safety and equipment reliability
- Analyse relevant electrical safety codes and standards in workplace practices
- Implement safety programs and follow good safety practices in the workplace

### TEXT BOOKS:

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis K Neitzel and Al Winfield, “Electrical Safety Handbook”, Fourth Edition, McGraw Hill, 2019.
2. Sunil S Rao, R K Jain and H L Saluja, “Electrical Safety, Fire Safety Engineering and Safety Management”, Khanna Publishers, 2012.

### REFERENCES:

1. Jain R K and Prof Sunil S Rao, “Industrial Safety, Health and Environment Management Systems”, Fourth Edition, Khanna Publishers, 2000.
2. Deshmukh L M, “Industrial Safety Management: Hazard Identification and Risk Control”, First Edition, McGraw Hill Education, 2017.
3. Poonia M P and Sharma S C, “Industrial Safety and Maintenance Management”, First Edition, Khanna Publishing House, 2019.
4. Anupama Prashar, “Industrial Safety and Environment”, S K Kataria and Sons, 2013.
5. Srinivasan S, “The Tamil Nadu Safety Officers Rules 2005”, Twenty Eighth Edition, Madras Book Agency, 2017.

### Mapping of COs with POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	–	1	–	–	–	–	2	3	2
CO2	3	3	2	2	–	2	–	–	–	–	2	3	2
CO3	3	3	3	2	–	2	–	–	–	–	2	3	2
CO4	3	3	2	3	–	–	–	–	–	–	2	3	2
CO5	3	3	3	3	–	–	–	–	–	–	2	3	2

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the basic electrical quantities and analysis methods in DC circuits
- Simplify DC circuits using network reduction techniques and fundamental theorems.
- Comprehend the principles of resonance and mutual inductance in AC circuits
- Analyze transient responses of RL, RC, and RLC circuits using Laplace transforms
- Explain single-phase and three-phase AC circuit characteristics

**UNIT I BASIC OF CIRCUITS**

6

Electrical quantities – Network elements – R, L, C parameters – Energy sources – Ohm's law – Kirchhoff's laws – Power in series circuits – Resistors in series and parallel – Mesh and Nodal analysis for DC circuits.

**UNIT II NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS**

6

Network reduction: Voltage and current division, Source transformation and Star delta conversion. Thevenin's theorem – Norton's theorem – Superposition theorem – Maximum power transfer theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS**

6

Resonance: Series and parallel resonance – Resonant frequency of tank circuit – Quality factor and bandwidth. Coupled circuits: Self and mutual inductance – Coefficient of coupling. Tuned circuits: Single tuned circuits.

**UNIT IV TRANSIENT RESPONSE ANALYSIS**

6

Transient response of RL, RC and RLC circuits using Laplace transform for DC input.

**UNIT V BASICS OF AC CIRCUITS**

6

Fundamentals of AC circuits – Single phase and three phase circuits – Power in R, RL and RLC circuits – Voltage and power measurements – Two wattmeter method – Applications.

**THEORY: 30 PERIODS**

*Prabakar*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

**LIST OF EXPERIMENTS:**

1. Simulation of electrical circuit problems using Kirchhoff's laws.
2. Simulation of electrical circuit problems using Mesh analysis.
3. Simulation of electrical circuit problems using Nodal analysis.
4. Simulation of electrical circuit problems using Thevenin's theorem.
5. Simulation of electrical circuit problems using Norton's theorem.
6. Simulation of electrical circuit problems using Superposition theorem.
7. Simulation of Maximum power transfer theorem.
8. Simulation of RC transients.
9. Simulation of RLC transients.

**PRACTICAL: 30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Solve DC circuits using mesh and nodal analysis techniques
- Apply network reduction methods and theorems to solve DC circuits
- Demonstrate the characteristics of resonant and coupled electrical circuits
- Analyze transient responses of electrical circuits using Laplace transforms
- Evaluate power in AC circuits and perform power measurements using standard methods

**TEXT BOOK:**

1. Sudhakar A and Shyam Mohan S P, "Circuits and Network Analysis and Synthesis", Fifth Edition, McGraw Hill, 2015.


**REFERENCES:**

1. Chakrabarti A, "Circuit Theory (Analysis and Synthesis)", Revised Edition, Dhanpat Rai and Company, 2023.
2. Salivahanan S, "Circuit Theory Analysis and Synthesis", First Edition, Pearson Education, 2021.
3. Cunningham D R and Stuller J A, "Basic circuit Analysis", Jaiho Publishing house, New Delhi, 2005.
4. William H Hayt, Jack Kemmerly and Steven Durbin M, "Engineering Circuit Analysis", Eighth Edition, McGraw Hill Publications, 2013.
5. Charles K Alexander and Matthew N O Sadiku, "Fundamentals of Electric Circuits", Sixth Edition, McGraw-Hill Education, 2019.
6. Robins and Miller, "Circuit Analysis Theory and Practice", Fifth Edition, Delmar Publishers, 2012.

  
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BoS (EEE)

**Mapping of COs with POs:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>C01</b>	3	2	1	1	2	–	–	2	–	–	2
<b>C02</b>	3	3	2	2	2	–	–	2	–	–	2
<b>C03</b>	3	3	2	2	2	–	–	2	–	–	2
<b>C04</b>	3	3	2	3	2	–	–	2	–	–	2
<b>C05</b>	3	3	2	2	2	–	–	2	–	–	2

  
**CHAIRMAN**  
**BoS (EEE)**

<b>24EE802PE</b>	<b>FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

The students should be made to,

- Understand the structure and operation of JFET and MOSFET devices
- Describe characteristics and operation of ideal and practical op-amps
- Learn the various applications of operational amplifiers
- Acquire the knowledge on the basic digital logic circuits
- Compare the various types of registers and memories

**UNIT I FIELD EFFECT TRANSISTORS** **9**  
 JFET and MOSFET devices: Device structure characteristics and equations – FET as amplifier – CS, CD and CG configurations.

**UNIT II OPERATIONAL AMPLIFIERS** **9**  
 Ideal op-amp characteristics, Basic op-amp configurations, Ideal op-amp circuit analysis, Loop gain – General operational amplifier stages and internal circuit diagrams of IC 741, Differential amplifier – Frequency response of op-amp – DC and AC performance characteristics and Slew rate.

**UNIT III APPLICATIONS OF AMPLIFIERS** **9**  
 Summer, differentiator and integrator, Instrumentation amplifier, AC amplifier, First order active filters, V/I and I/V converters, Comparators, S/H circuit, Log and anti-log amplifier, Multiplier and divider.

**UNIT IV BOOLEAN ALGEBRA AND GATE LEVEL MINIMIZATION** **9**  
 Boolean theorems and properties – Boolean functions – Logic gates – Gate level minimization using Karnaugh map, SOP and POS simplification, Don't care conditions and Implementations of logic functions using gates – NAND-NOR implementations.

**UNIT V REGISTERS AND MEMORIES** **9**  
 Shift registers, Ring counter – Shift counters – Memories: ROM – PROM – EPROM – EEPROM – EAPROM – RAM – FLASH Memories – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – FPGA.

**TOTAL: 45 PERIODS**

*PSP*  
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**BoS (EEE)** 16/10/25  
 260

**COURSE OUTCOMES:****On successful completion of this course, the students will be able to,**

- Understand the characteristics and configuration of FET
- Analyze op-amp circuits including frequency response and slew rate
- Summarize the applications of operational amplifier
- Minimize logic expressions using Karnaugh maps and implement using gates
- Explain the operation and applications of shift registers and programmable logic devices

**TEXT BOOKS:**

1. Roy Choudhry D and Shail Jain, "Linear Integrated Circuits", Fourth Edition, New Age International Private Limited, 2018.
2. Morris Mano M and Michael D Ciletti, "Digital Design", Sixth Edition, Pearson, 2018.

**REFERENCES:**

1. Salivahanan S and Kanchana Bhaskaran V S, "Linear Integrated Circuits", Sixth Reprint, Tata McGraw Hill, Second Edition, 2010.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Fourth Edition, Tata McGraw Hill, 2016.
3. William D Stanley, "Operational Amplifiers with Linear Integrated Circuits", Fourth Edition, Pearson Education, 2001.
4. Salivahanan S and Arivazhagan S, "Digital Electronics", First Edition, Vikas Publishing House Private Limited, 2012.
5. Anand Kumar A, "Fundamentals of Digital Circuits", Fourth Edition, PHI learning Private Limited, 2016.

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	1	–	–	–	–	–	–	2
<b>CO2</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO4</b>	3	3	2	2	–	–	–	–	–	–	2
<b>CO5</b>	3	3	2	2	–	–	–	–	–	–	2

*PBB*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:**

The students should be made to:

- Understand principles of electromechanical energy conversion and magnetic circuits
- Describe working and characteristics of DC machines
- Analyze the performance, efficiency and voltage regulation of transformers
- Explain operation principles of synchronous and induction machines
- Assess various speed control and braking methods of DC and AC motors

**UNIT I ELECTROMECHANICAL ENERGY CONVERSION 9**

Fundamentals of magnetic circuits – Principle of electromechanical energy conversion forces and torque in magnetic field systems – Energy in magnetic system – Field energy and mechanical force – Single and Multiple excited magnetic systems – MMF of distributed AC windings – Torque in round rotor machine.

**UNIT II DC MACHINES 9**

DC generator – Types – EMF equation – Armature reaction – Compensating winding – commutation – Methods of excitation – DC motor – Torque equations and power developed by armature – Characteristics of DC motor – Applications of DC motors.

**UNIT III TRANSFORMERS 9**

Construction and practical considerations – Transformer on No-Load – Equivalent circuit – Transformer losses – Efficiency and voltage regulation – Autotransformer.

**UNIT IV AC MACHINES 9**

Synchronous machines – Constructional details – Principle of operation – Characteristics – Induction machines – Types of rotors – Squirrel Cage and Slip Ring – Principle of operation – Slip – Torque equations – Slip-Torque characteristics – Applications.

**UNIT V SPEED CONTROL OF MOTORS 9**

Speed control of DC motors – Speed control of Induction motors – Braking of DC and AC motors – Different methods of braking.

**TOTAL: 45 PERIODS**

*PSPROKAT*  
**CHAIRMAN**  
 BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Analyze forces and torque in magnetic field systems
- Explain torque and power developed in DC motors
- Calculate efficiency and voltage regulation of transformers
- Analyze slip and torque characteristics of induction motors
- Apply speed control techniques for DC and induction motors

### TEXT BOOK:

1. Nagrath I J and D. P Kothari D P, "Electric Machines", Fifth Edition, McGraw Hill Education, 2018.

### REFERENCES:

1. Bimbhra P S, "Electric Machinery", Second Edition, Khanna Publishers, 2021.
2. Fitzgerald A E and C. Kingsley, "Electric Machinery", Sixth Edition, McGraw Hill Education, 2017.
3. Gupta B R, Vandana singhal "Fundamental of Electric Machines" Third Edition, New age International Publishers, Reprint 2015.
4. Clayton E and Hancock N N, "Performance and design of DC machines", CBS Publishers, 2018.
5. Stephen J Chapman, "Electric Machinery Fundamentals" Fourth Edition, McGraw Hill Education Pvt. Ltd., 2010.
6. Rajput R K., "Electrical Machines", Sixth Edition, Laxmi Publications, New Delhi, 2018.
7. Theraja B L and Theraja A K, "A Textbook of Electrical Technology (Volume-II)", S Chand and Company, 2012.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	2	2	-	-	-	-	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	2
CO5	3	3	3	2	-	-	-	-	-	-	2

*PSP*  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Understand the fundamentals of measurement systems and error analysis
- Learn the principles and uses of different electrical measuring instruments
- Identify various transducers and display devices and their applications
- Apply control system concepts to model mechanical and analog systems
- Analyze time and frequency response methods to assess the stability and performance of control systems

**UNIT I INTRODUCTION**

6

**Measurements:** Importance – Method of measurements – Elements of generalized measurement system – Error in measurement – Types of error – Statistical evaluation of measurement data – Standards and calibration.

**Instruments:** Classification of instruments – Deflection and null type instruments – Types – current transformers.

**UNIT II ELECTRICAL MEASUREMENTS**

6

Moving iron instruments – Moving coil instruments – Energy meter – Watt meter – Power factor meter – Megger – Flux meter.

**UNIT III TRANSDUCER**

6

Introduction – Classification of transducer: Capacitive, LVDT and Strain Gauge – LCD – LED – Magnetic tape recorders.

**UNIT IV SYSTEM MODELING**

6

Basic elements in control systems – Open and closed loop systems – Differential equations – Transfer function – Modeling of mechanical translational and rotational systems – Introduction to analogous system.

**UNIT V STABILITY ANALYSIS**

6

**Time response:** Introduction – First order system – Second order system – Routh Hurwitz criterion.

**Frequency Response:** Introduction – Frequency domain specifications – Bode plot and Polar plot.

**THEORY: 30 PERIODS**

*Debraj Kumar*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

### LIST OF EXPERIMENTS:

1. Measurement of displacement using LVDT.
2. Analog to Digital converter.
3. Optical transducer- Photo diode.
4. Design of instrumentation amplifier.
5. Flow measurement using flow sensor.
6. Digital simulation of first order system.
7. Digital simulation of second order system.
8. Stability analysis of linear systems by Bode plot.

**LABORATORY: 30 PERIODS**  
**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Identify instrument types and errors to perform standardized measurements
- Describe the operation of moving iron, moving coil instruments
- Compare the types and applications of various transducers
- Develop models for mechanical and analog control systems using transfer function
- Analyze time and frequency response to determine system stability

### TEXT BOOKS:

1. Sawhney A K, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Company, 2019.
2. Salivahanan S, Rengaraj R and Venkatakrishnan G R, "Control Systems Engineering", First Edition, Pearson, 2015.

### REFERENCES:

1. Nagrath J and Gopal M, "Control System Engineering", Sixth Edition, New Age International Publishers, 2018.
2. Gopal M, "Control System – Principles and Design", Fourth Edition, McGraw Hill Education (India) Private Limited, 2012.
3. Anand Kumar A, "Control Systems", Second Edition, Prentice Hall India Learning Private Limited, 2014.
4. Kalsi H S, "Electronic Instrumentation", Third Edition, McGraw Hill, 2017.
5. Murthy D V S, "Transducers and Instrumentation", Prentice Hall of India Private Limited, 2015.

  
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**BoS (EEE)**

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	3	2	2	-	-	-	1	-	-	2
<b>CO2</b>	3	2	2	2	-	-	-	1	-	-	2
<b>CO3</b>	3	2	2	2	2	-	-	1	-	-	2
<b>CO4</b>	3	3	3	3	2	-	-	-	-	-	2
<b>CO5</b>	3	3	3	3	2	-	-	-	-	-	2

~~P. Pradyot~~  
CHAIRMAN 16/10/25  
BoS (EEE)

**COURSE OBJECTIVES:**

**The students should be made to:**

- Learn the basics and features of power semiconductor devices
- Understand the operation of controlled rectifiers with different load conditions
- Explore the principles, control strategies and applications of DC-DC choppers
- Examine the operation and modulation techniques of voltage source inverters
- Illustrate AC voltage controllers, cycloconverters and their practical applications

**UNIT I POWER SEMICONDUCTOR DEVICES 9**

Power switching devices overview: V-I and switching characteristics of power diode, BJT, MOSFET, IGBT, SCR, TRIAC and GTO – Thyristor turn ON and turn OFF methods.

**UNIT II CONTROLLED RECTIFIERS 9**

Operation and analysis of single and three phase rectifiers – Half and fully controlled converters with R and RL load – Dual converter.

**UNIT III CHOPPERS 9**

Principles of high-power chopper circuits – Control strategies – Class A, B, C and D chopper – Principle of operation of buck and boost regulators.

**UNIT IV INVERTERS 9**

Principle of operation of single phase VSI – Analysis of three phase inverter circuits with star load by 120 and 180 degree conduction mode – PWM techniques: Single pulse, multiple pulse sinusoidal and space vector modulation.

**UNIT V AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS 9**

Principle of phase and Integral cycle control – Single phase voltage controllers with R load. Cycloconverters: Single phase to single phase and single phase to three phase cycloconverters, Matrix converter circuit. Applications: SMPS and UPS systems.

**THEORY: 45 PERIODS**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify and explain the basics and characteristics of power semiconductor devices
- Analyze the operation and performance of single-phase and three-phase controlled rectifiers
- Apply control strategies to various types of chopper circuits and DC–DC regulators
- Evaluate the operation and modulation techniques of inverters under different conduction modes
- Demonstrate the operation and practical uses of AC voltage controllers and cycloconverters

### TEXT BOOK:


1. Bimbra P S, “Power Electronics”, Fifth Edition, Khanna Publishers, 2012.

### REFERENCES:

1. Muhammad H Rashid, “Power Electronics: Devices, Circuits and Applications”, Fourth Edition, Pearson Education, New Delhi, 2018.
2. Ned Mohan Tore, Undel M and William P Robbins, “Power Electronics: Converters, Applications and Design”, Third Edition, John Wiley and Sons, 2003.
3. Singh M D and Khanchandani K B, “Power Electronics”, Second Edition, McGraw Hill India, 2017.
4. Ashfaq Ahmed, “Power Electronics for Technology”, First Reprint, Pearson Education, 2003.
5. Joseph Vithayathil, “Power Electronics, Principles and Applications”, Sixth Reprint, McGraw Hill Series, 2013.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	1	–	–	–	–	–	–	2
<b>CO2</b>	3	3	2	2	–	–	–	–	–	–	2
<b>CO3</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO4</b>	3	3	3	2	–	–	–	–	–	–	2
<b>CO5</b>	3	3	3	2	–	–	–	–	–	–	2

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:**

The students should be made to:

- Learn the basic concepts and instruction set of the 8085 Microprocessor
- Develop programming skills for the 8085 microprocessor
- Learn interfacing techniques of the 8085 microprocessor with peripheral devices
- Understand the internal architecture, addressing modes and memory interfacing of the 8086 microprocessor
- Describe the operation of the 8259-interrupt controller and basic applications using 8085

**UNIT I ARCHITECTURE OF 8085**

6

Functional block diagram — Registers, ALU, Bus systems. Pin configuration, Timing and control signals.

**UNIT II PROGRAMMING OF 8085**

6

Data transfer operations, Arithmetic operations, logical operations, Branch control operations and stack – I/O and Machine control operations – Stack and subroutines – Addressing modes.

**UNIT III INTERFACING DEVICES**

6

8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085. 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

**UNIT IV 8086 MICROPROCESSOR**

6

Intel 8086 Internal Architecture – Pin diagram – 8086 addressing modes – Physical memory organization. Interfacing 8086 with memory and I/O devices under minimum mode (Block-diagram level).

**UNIT V INTERRUPT CONTROLLER AND APPLICATIONS**

6

8259 Interrupt controller chip: Architecture, pin configuration, control words and modes – Stepper motor and Traffic light control using 8085.

**THEORY: 30 PERIODS**

*P. P. Rao*  
 CHAIRMAN  
 BoS (EEE)

16/10/25

### LIST OF EXPERIMENTS:

1. Addition and subtraction of 8-bit numbers using the 8085.
2. Addition and subtraction of 16-bit numbers using the 8085.
3. Multiplication and division of two 8-bit numbers using the 8085.
4. Multiplication and division of two 16-bit numbers using the 8085.
5. Program to convert binary data to BCD using the 8085.
6. Program to convert BCD data to binary using the 8085.
7. Find the largest and smallest number in an array using 8085.
8. Arrange an array of data in ascending and descending order using 8085.
9. Stepper motor speed control using the 8085.
10. Traffic light control using 8255 PPI with the 8085.

**PRACTICAL: 30 PERIODS**  
**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Explain the fundamental concepts and instruction set of the 8085 microprocessor
- Write and debug assembly language programs for the 8085 microprocessor to basic computational problems
- Demonstrate interfacing techniques of the 8085 microprocessor with various peripheral devices
- Describe the internal architecture, addressing modes and memory interfacing of the 8086 microprocessor
- Illustrate the operation of the 8259-interrupt controller and apply it in basic applications using the 8085 microprocessor

### TEXT BOOKS:

1. Gaonkar R S, "Microprocessor Architecture, Programming and its Applications with 8085", Sixth Edition, Penram Publications, 2013.
2. Douglas V Hall, "Microprocessors and interfacing programming and hardware", Third Edition, Tata McGraw-Hill, 2017.

### REFERENCES:

1. Douglas V Hall and SSSP Rao, "Microprocessors and Interfacing", Third Edition, McGraw Hill Education, 2017.
2. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers Architecture, Programming and Interfacing Using 8085, 8086 and 8051", McGraw Hill Education, 2017.
3. Udaya Kumar K, "Microprocessors", First Edition, Pearson Education, 2012.
4. Krishna Kant, "Microprocessor and Microcontrollers: Architecture Programming and System Design", Second Edition, Prentice Hall India Learning Private Limited, 2013.
5. Senthil Kumar N, Saravanan M and Jeevananthan S, "Microprocessor and Microcontroller", Twelfth Impression, Oxford University Press, 2015.



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**BoS (EEE)**

**Mapping of COs with POs:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>C01</b>	3	2	1	1	2	-	-	-	-	-	2
<b>C02</b>	3	3	2	1	2	-	-	-	-	-	2
<b>C03</b>	3	3	3	2	3	-	-	-	-	-	2
<b>C04</b>	3	2	2	1	2	-	-	-	-	-	2
<b>C05</b>	3	3	3	2	3	-	-	-	-	-	2

*PSP Books*  
**CHAIRMAN**  
**BoS (EEE)**

**COURSE OBJECTIVES:****To student should be made to:**

- Learn the structure, components and basic concepts of power systems
- Analyze AC and DC transmission and distribution systems
- Calculate inductance and capacitance for overhead transmission lines and classify transmission line types
- Explain mechanical design aspects of transmission lines
- Understand different tariff types and perform tariff calculations

**UNIT I INTRODUCTION TO POWER SYSTEM 9**

Power scenario in Indian Grid – Structure of power system – Conventional sources of electric energy – Environmental aspects of electric energy generation – Various voltage levels – Concept of frequency and power factor – Basics of alternating current (AC) and direct current (DC) systems.

**UNIT II TRANSMISSION AND DISTRIBUTION SYSTEMS 9**

DC 2-wire and 3-wire systems, AC single phase and three phase with 4-wire systems, Comparison of copper efficiency.

**Distribution Systems:** Primary and secondary distribution systems, Concentrated and uniformly distributed loads on distributors fed at one and both ends, Ring distribution, Submains and tapered mains – Voltage drop and power loss calculations – Voltage regulators.

**UNIT III OVERHEAD TRANSMISSION LINES 9**

Types of conductors – Line parameters: Calculation of inductance and capacitance of single phase, three phase transposed line. Classification of transmission lines – Regulation and efficiency.

**UNIT IV MECHANICAL DESIGN OF TRANSMISSION LINES 9**

Types of insulators, String efficiency, Voltage distribution in string of suspended insulators – Different types of towers. Sag-tension calculations, Sag template, String charts – Corona and corona losses.

**UNIT V TARIFFS 9**

Tariff – Types and tariffs for domestic, commercial and industrial consumers – Calculation of tariff.

**TOTAL: 45 PERIODS**

*P. S. Prasad*  
 CHAIRMAN  
 BoS (EEE) 16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the structure of power systems and outline the Indian power scenario
- Apply the principles of AC, DC power transmission and distribution systems
- Estimate line parameters, voltage drops and efficiency of transmission lines
- Evaluate the performance of overhead transmission lines and their mechanical design
- Calculate electricity tariffs for different consumers

### TEXT BOOK:

1. Kothari D P and Nagrath I J, "Power System Engineering", Third Edition, McGraw-Hill Publishing Company limited, New Delhi, 2019.

### REFERENCES:

1. Uppal S L and Prof. Rao S, "Electrical Power Systems", Khanna Publishers, 2009.
2. Chakrabarti A, Soni M L and Gupta P V, "A Text Book on Power Systems Engineering", First Edition, Dhanpat Rai Publishing Company Limited, 2009.
3. Wadhwa C L, "Electrical Power Systems", Seventh Edition, New Age International Publishers, 2015.
4. Singh S N, "Electric Power Generation, Transmission and Distribution", Second Edition, Prentice Hall of India Private Limited, New Delhi, 2011.
5. Mehta V K and Rohit Mehta, "Principles of Power Systems", S Chand and Company 2011.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	-	-	-	-	-	-	2
CO2	3	3	2	1	-	-	-	-	-	-	2
CO3	3	3	2	2	-	-	-	-	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	2
CO5	2	2	2	1	-	-	-	-	-	-	2

*P. S. Rao*  
CHAIRMAN  
BoS (EEE)

**OBJECTIVES:**

The students should be made to:

- Learn the principles of various lighting schemes
- Understand the different methods of electric heating and welding
- Know various electric drives and traction motors with applications
- Impart the knowledge on refrigeration and air conditioning
- Study the domestic utilization of electrical energy

**UNIT I ILLUMINATION 9**

Introduction – Terminology, Laws of illumination, Photometry, Lighting calculations. Electric lamps – Different types of lamps, LED lighting and energy efficient lamps – Design of lighting schemes – Factory lighting – Flood lighting – Street lighting.

**UNIT II ELECTRIC HEATING AND WELDING 9**

Electric heating – Types of heating and applications. Electric furnaces – Resistance, inductance and arc furnaces – Electric welding and sources of welding – Electrolytic processes – Electro-metallurgy and Electroplating.

**UNIT III TRACTION SYSTEM 9**

Introduction – Traction system – Power supply, Traction drives, Electric braking, Tractive effort calculations and speed–time characteristics. Locomotives and train – Recent trends in electric traction.

**UNIT IV REFRIGERATION AND AIR CONDITIONING 9**

Refrigeration – Domestic refrigerator and water coolers – Air Conditioning – Various types of air conditioning system and their applications, Smart air conditioning units – Energy efficient motors: Standard motor efficiency, Need for more efficient motors, Motor life cycle, Direct savings and payback analysis – Efficiency evaluation factor.

**UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9**

House wiring – Induction based appliances – Online and Offline UPS – Batteries – Power quality aspects – Nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

**TOTAL: 45 PERIODS**

*P. S. Rao*  
CHAIRMAN  
BoS (EEE) 16/10/25  
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**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the working of various lighting
- Analyze the working of electric heating and welding systems
- Interpret the working of electric traction system
- Demonstrate the operation of refrigeration and air conditioning system
- Evaluate the domestic utilization of electrical energy

**TEXT BOOK:**

1. Wadhwa C L, "Generation, Distribution and Utilization of Electrical Energy", Third Edition, New Age International Limited Publishers, 2010.

**REFERENCES:**

1. Gupta J B, Rajeev Manglik and Rohit Manglik, "Utilization of Electric Energy and Traction", Reprint, Kataria and Sons Publishers, 2014.
2. Dr Uppal S L and Prof Rao S, "Electrical Power Systems", Fifteenth Edition, Khanna Publishers, New Delhi, 2014.
3. Gupta J B, "Utilization of Electric Power and Electric Traction", S K Kataria and Sons, 2002.
4. Taylor E "Utilization of Electrical Energy", The Orient Blackswan, 1971.

**Mapping of COs with POs:**

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CO1	3	2	2	1	–	–	–	–	–	–	2
CO2	3	3	2	2	–	–	–	–	–	–	2
CO3	3	2	2	2	–	–	–	–	–	–	2
CO4	3	2	2	1	–	–	–	–	–	–	2
CO5	3	2	3	2	–	–	–	–	–	–	2

  
CHAIRMAN  
BoS (EEE)

**COURSE OBJECTIVES:****The students should be made to:**

- Learn the architecture of industrial automation systems along with measurement and data acquisition system characteristics
- Explain PID control concepts, tuning methods, and special control structures used in process control
- Describe PLC operation, relay ladder logic programming and the hardware environment for sequence control
- Understand flow control valves, hydraulic and pneumatic control systems, and energy-saving techniques
- Interpret the basics of industrial robots, their applications and the role of IoT and Industry 4.0 in plant automation

**UNIT I INTRODUCTION**

9

Introduction – Architecture of industrial automation systems – Measurement systems characteristics – Data acquisition systems – Introduction to automatic control.

**UNIT II PROCESS CONTROL**

9

PID Controller – Controller tuning – Implementation of PID controllers – Special control structures: Feed forward and ratio control – Special control structures: Predictive control, control of systems with inverse response.

**UNIT III SEQUENCE CONTROL**

9

PLCs and Relay Ladder Logic (RLL) – Scan Cycle, RLL syntax – Structured design approach – Advanced RLL programming – The hardware environment.

**UNIT IV FLOW CONTROL VALVES**

9

Flow control valves – Hydraulic control systems –Industrial hydraulic circuit – Pneumatic control systems – Energy savings with variable speed drives – Introduction to CNC machines.

**UNIT V INDUSTRIAL AUTOMATION USING ROBOTS**

9

Basic construction and configuration of robot pick and place robot – Welding robot – Internet of things for plant automation and overview of industry 4.0.

**TOTAL: 45 PERIODS**

*P. S. S. S.*  
CHAIRMAN  
BoS (EEE)

16/10/25

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Identify components and functions of industrial automation systems
- Apply PID control concepts, tuning techniques, and special control structures in process control applications
- Demonstrate PLC operations and develop relay ladder logic programs for sequence control
- Analyze the operation of flow control valves, hydraulic and pneumatic systems
- Simulate industrial robots for the impact of IoT and Industry 4.0 on plant automation

### TEXT BOOKS:


1. Mukhopadhyay S, Sen S and Deb A K, "Industrial Instrumentation, Control and Automation", Jaico Publishing House, 2013.
2. George Stephanopoulos, "Chemical Process Control, An Introduction to Theory and Practice", First Edition, Pearson Education India, 2015.

### REFERENCES:

1. John W Webb and Ronald A Reis, "Programmable Logic Controllers: Principles and Applications", Fifth Edition, Prentice Hall India Learning Private Limited, 2002.
2. Manoj K S, "Industrial Automation with SCADA: Concepts, Communications and Security", First Edition, Notion Press, 2019.
3. Krishnan R, "Electric Motor Drives, Modelling, Analysis and Control", Prentice Hall of India, 2002.
4. Gary Dunning, "Introduction to Programmable Logic Controllers", Delmar Cengage Learning, 2005.
5. Katariya Sanjay B, "Industrial Automation Solutions for PLC, SCADA, Drive and Field Instruments", Harpercollins 360, 2020.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO3	3	2	3	2	-	2	-	-	-	-	2
CO4	3	3	2	3	-	-	-	-	-	-	2
CO5	3	2	3	3	-	-	-	-	-	-	2

  
CHAIRMAN  
BoS (EEE)

24EE810PE

**RENEWABLE ENERGY ENGINEERING:  
SOLAR, WIND AND BIOMASS ENERGY  
SYSTEMS**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

**The students should be made to:**

- Understand the principles of renewable energy and its role in sustainable development
- Explore the fundamentals of solar energy, solar radiation measurements and ways to utilize solar energy
- Impart knowledge on biomass resources and conversion technologies
- Analyze biochemical and thermo-chemical conversion processes for biofuels and energy production
- Learn the principles of wind energy, turbine systems and methods for power generation from wind

**UNIT I INTRODUCTION**

9

Principles of renewable energy: Energy and sustainable development, fundamentals and social implications – Worldwide renewable energy availability – Renewable energy availability in India – Solar energy: Basics and concepts, Non-concentrating solar collectors – Practice problems.

**UNIT II SOLAR ENERGY**

9

Fundamentals – Solar radiation: Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation measurements – Pyrheliometers, Pyrometer, Sunshine recorder Concentrating solar collectors, storage systems – Thermal energy storage systems and solar energy utilization methods.

**UNIT III BIOMASS ENERGY**

9

Introduction – Photosynthesis process – Biofuels – Biomass resources – Biomass conversion technologies-fixed dome – Urban waste to energy conversion – Biomass gasification (Downdraft). Biomass types and characterization.

**UNIT IV BIOCHEMICAL CONVERSION PROCESSES**

9

Introduction to Biochemical conversion – Fundamentals of Bioconversion – Fermentation technology – Basics of Biochemical conversion processes – Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass – Biomass gasification – Biomass pyrolysis and liquefaction.

~~PSS~~  
CHAIRMAN  
BoS (EEE) 16/10/25

## UNIT V WIND ENERGY

9

Wind Energy: Basics, Turbine terms, Types and theories, Properties of wind, availability of wind energy in India, Wind velocity and power from wind – Major problems associated with wind power – Basic components of WECS, Classification of WECS: Horizontal axis, single, double, multiblade system and vertical axis – Savonius and darrieus types – Characteristics and power generation from wind energy.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the fundamental principles of renewable energy and its importance in promoting sustainable development.
- Illustrate the principles of solar energy and its measuring and the technologies for utilize solar energy effectively
- Explain different conversion technologies for energy production from various biomass resources
- Examine various biochemical and thermo-chemical processes for converting biomass into biofuels
- Assess the effectiveness of different wind turbine designs and power generation methods.

### TEXT BOOK:

1. Kothari P, Singal K C and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, Printice Hall of India Private Limited, New Delhi, 2008.

### REFERENCES:

1. Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, Third Edition, Oxford University Press, 2012.
2. Twidell J W and Weir A, “Renewable Energy Sources”, Third Edition, EFN Spon Limited, UK, 2015.
3. Tiwari G N, “Solar Energy - Fundamentals Design, Modelling and Applications”, Narosa Publishing House, New Delhi, 2012.
4. Gilbert M Master, “Renewables and Efficient Electric Power Systems”, Second Edition, John Wiley and Sons, 2013.
5. Rai G D, “Non-Conventional Sources of Energy Sources”, Khanna Publishers, 2012.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	–	–	–	–	–	–	2
CO2	3	3	2	2	–	–	–	–	–	–	2
CO3	3	3	3	2	–	–	–	–	–	–	2
CO4	3	3	3	2	–	–	–	–	–	–	2
CO5	3	3	3	2	–	–	–	–	–	–	2

*PSP Books*  
**CHAIRMAN**  
**BoS (EEE)**

(15/01/2024)

**24AD101OE      INTRODUCTION TO ARTIFICIAL INTELLIGENCE      L T P C**  
**(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH)      3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the concept of intelligent agents and their interaction with environments
- Explore local search approaches in continuous spaces
- Study knowledge engineering approaches within first-order logic
- Examine planning graphs and their role in efficient planning
- Apply the role of knowledge representation in the learning process

**UNIT I      INTRODUCTION      9**

Intelligent Agents - Agents and environments - good behavior - The nature of environments - Structure of agents - Problem Solving - Problem solving agents - Uniformed search strategies - Avoiding repeated states-Searching with partial information.

**UNIT II      SEARCHING TECHNIQUES      9**

Informed search and exploration - Informed search strategies - heuristic function - Local search algorithms and optimization problems - Local search in continuous spaces - Online search agents and unknown environments - Constraint satisfaction problems (CSP) - Backtracking search and Local search for CSP.

**UNIT III      KNOWLEDGE REPRESENTATION      9**

First order logic - Representation revisited - Syntax and semantics for first order logic - Using first order logic - Knowledge engineering in first order logic - Inference in First order logic - Propositional versus first order logic - Unification and lifting - Forward chaining - Backward Chaining-Ontological Engineering.

**UNIT IV      PLANNING      9**

Planning problem- Planning with state space search - Partial order planning - Planning graphs - Planning with proportional logic - Time, Schedules, and Resources - Hierarchical task Planning - Conditional Planning - Execution monitoring and re planning - Continuous planning.

**UNIT V      LEARNING      9**

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning - Logical formulation of learning - Explanation based learning - Learning using relevant information-Statistical Learning Methods - Case Study on AI-Assisted X-Ray Analysis.

**TOTAL: 45 PERIODS**

  
**CHAIRMAN**  
**BoS (AD)**

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply the concept of problem-solving agents to real-world problem domains
- Implement local search algorithms to solve optimization
- Demonstrate knowledge engineering processes using FOL
- Utilize planning graphs to represent and solve planning tasks
- Analyze the role of knowledge in supporting effective learning

## TEXT BOOKS:

1. Stuart J Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 4<sup>th</sup> Edition, 2023.
2. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 6<sup>th</sup> Edition, 2021.

## REFERENCES:

1. Engene Charniak and Drew Mc Dermott, "Introduction to Artificial Intelligence", Addison Wesley, 2013.
2. Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 2002.
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, Books 3<sup>rd</sup> Edition, 2000.

## Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	3	1	-	2	2	2	2
CO2	3	2	2	2	3	1	-	1	1	2	2
CO3	3	3	2	2	3	1	-	2	1	2	2
CO4	3	2	3	2	3	1	-	1	2	2	2
CO5	3	2	2	3	3	1	-	2	2	3	3

  
CHAIRMAN  
BoS (AD)

24AD102OE

**INTRODUCTION TO DATA SCIENCE**  
**(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH)**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the fundamental concepts of data science, its lifecycle, and applications
- Acquire, preprocess, and manage different types of data
- Apply probability and statistical techniques for analyzing data
- Develop predictive models using regression analysis
- Analyze networks and social data using graph theory

UNIT I	FUNDAMENTALS OF DATA SCIENCE	9
Introduction to Data Science - Data Science Lifecycle - Applications of Data Science in Various Domains - Types of Data: Structured, Unstructured, Semi-Structured - Characteristics of Big Data - Roles in Data Science - Challenges in Data Science - Data Ethics and Privacy Issues - Future Trends in Data Science.		
UNIT II	DATA COLLECTION AND PREPROCESSING	9
Sources of Data - Data Acquisition Methods - Data Integration and Transformation - Handling Missing Values - Identifying and Removing Duplicates - Data Normalization and Standardization - Outlier Detection and Handling - Exploratory Data Analysis (EDA) - Case Study Using EDA.		
UNIT III	PROBABILITY AND STATISTICS FOR DATA SCIENCE	9
Introduction to Probability - Probability Distributions - Random Variables - Sampling Methods - Central Limit Theorem - Hypothesis Testing - Confidence Intervals - Correlation and Regression - Statistical Significance - Applications of Statistics in Data Science		
UNIT IV	REGRESSION ANALYSIS	9
Regression Analysis, Regression: Linear Regression Simple Linear Regression, Multiple & Polynomial Regression, Sparse Model - Unsupervised Learning, Clustering, Similarity and Distances, Quality Measures of Clustering - Case Study.		
UNIT V	NETWORK ANALYSIS	9
Network Analysis - Graphs - Social Networks - Centrality - Drawing centrality of Graphs - PageRank - Ego-Networks - Community Detection.		

**TOTAL: 45 PERIODS**

  
**CHAIRMAN**  
**BoS (AD)**

**OUTCOMES:**

**On Successful completion of this course, the students will be able to,**

- Perform Exploratory Data Analysis to summarize data and gain insights
- Apply probability, statistical methods, and hypothesis testing to solve data-related problems
- Build and evaluate regression models for prediction and analysis
- Implement clustering techniques and evaluate clustering quality for unsupervised learning tasks
- Analyze complex networks and social graphs using centrality measures, PageRank, and community detection techniques

**TEXT BOOK:**

1. Foster Provost & Tom Fawcett, “Data Science for Business” 1st Edition, O’Reilly Media, 2013.

**REFERENCES:**

1. Wes McKinney “Python for Data Analysis”, 2nd Edition, O’Reilly, 2017.
2. Péter Bruce, Andrew Bruce “Practical Statistics for Data Scientists”, 2017.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining 2nd Edition, Pearson, 2019.
4. Albert-László Barabási, “Network Science” – Cambridge University Press, 2016.

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	1	2	2	-	1	2	3
CO2	3	3	2	3	2	2	2	-	1	2	3
CO3	3	3	3	3	2	2	2	-	-	2	3
CO4	3	3	-	3	3	2	1	-	2	2	3
CO5	2	2	3	2	3	2	1	-	2	2	2

  
**CHAIRMAN**  
**BoS (AD)**

**OBJECTIVES:**

The student should be made to:

- Learn how biological and environmental factors affect crop growth
- Understand proper plant spacing and nursery techniques for better crop establishment
- Plan and manage water, nutrients, crop protection, fertigation and harvesting effectively
- Identify the main causes of post-harvest losses in cereals, pulses and oilseeds
- Evaluate cleaning and grading equipment based on their efficiency and performance for different crops

**UNIT I AGRICULTURE AND CROP PRODUCTION 9**

Introduction to agriculture and its crop production sub-sectors – field crop production and Horticulture – Factors affecting crop growth and production: genetic (internal) and environmental (external) factors – Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices.

**UNIT II CROP SELECTION AND ESTABLISHMENT 9**

Regional and seasonal selection of crops – Systems of crop production – Competition among crop plants – Spacing and arrangement of crop plants – Establishment of an adequate crop stand and ground cover – including selection and treatment of seed and nursery growing.

**UNIT III CROP MANAGEMENT 9**

Crop water Management – Crop nutrition management – need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling – Integrated methods of managing water, nutrients and plant protection – Types and methods of harvest.

**UNIT IV POST HARVESTING 9**

Post harvest technology – introduction – objectives – post harvest losses of cereals, pulses and oilseeds – importance – optimum stage of harvest. Threshing – traditional methods mechanical threshers – types - principles and operation - moisture content.

**UNIT V CLEANING AND GRADING 9**

Principles – air screen cleaners – adjustments – cylinder separator – spiral separator – magnetic separator – colour sorter – inclined belt separator – length separators – effectiveness of separation and performance index.

**TOTAL: 45 PERIODS**

V. GORDE

CHAIRMAN  
BoS (AGE) 28.10.25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand genetic and environmental factors influencing crop growth
- Apply engineering knowledge for crop selection, spacing and cropping system design
- Develop integrated water, nutrient and plant protection management for sustainability
- Solve agricultural problems using research, experiment design and data analysis
- Analyze cleaning and grading equipment based on efficiency and performance indices

**TEXT BOOK:**

1. Rajendra Prasad, “Textbook of Field Crops Production Volume 1 and 2”, Indian Council of Agricultural Research, New Delhi, 2017
2. Reddy S R, “Principles of Agronomy”, Kalyani Publishers, New Delhi, 2018
3. Chakraverty A, “Post harvest technology for Cereals, Pulses and oil seeds”, Oxford & IBH publication Pvt Ltd, New Delhi, 3<sup>rd</sup> Edition, 2019

**REFERENCES:**

1. Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore, 2020
2. Kumar N, “Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants”, Oxford and IBH Publishing Co. Pvt. Ltd, 2<sup>nd</sup> Edition, 2018
3. Rathore N S, Mathur G K and Chasta S S, “Post-Harvest Management and Processing of Fruits and Vegetables”, ICAR, The Energy and Resources Institute, India, 2012

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	1



CHAIRMAN  
BoS (AGE)

**OBJECTIVES:**

**The student should be made to:**

- Understand the classification of tractors and the operation of tractor engines
- Identify the concepts and functions of various engine systems
- Apply the principles and methods of operation for sowing and fertilizing equipment
- Analyze the types and performance of equipment used for weeding and plant protection
- Examine the working principles and operational efficiency of harvesting machinery

**UNIT I      TRACTORS** **9**

Classification of tractors – Tractor engines – construction of engine blocks, cylinder head and crankcase – features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers - Electronics and Guidance System of Tractor.

**UNIT II      ENGINE SYSTEMS** **9**

Valves – inlet and outlet valves – valve timing diagram. Air cleaner – exhaust – silencer. Cooling systems – lubricating systems – fuel system – governor – electrical system.

**UNIT III      SOWING AND FERTILIZING EQUIPMENT** **9**

Crop planting – methods – row crop planting systems – Devices for metering seeds – furrow openers – furrow closers – types – Types of seed drills and planters – calibration-fertilizer metering devices – seed cum fertilizer drills – paddy transplanters – nursery tray machines.

**UNIT IV      WEEDING AND PLANT PROTECTION EQUIPMENT** **9**

Weeding equipment – hand hoe – long handled weeding tools – dry land star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders. Sprayers – types – classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.

**UNIT V      HARVESTING MACHINERY** **9**

Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses.

**TOTAL: 45 PERIODS**



CHAIRMAN  
BoS (AGE) 28.10.25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand tractor engine components, electronics and guidance systems
- Apply knowledge of engine operation, valves and electrical systems
- Operate and maintain sowing and fertilizing equipment through seed/fertilizer metering and calibration
- Evaluate weeding and plant protection equipment based on atomization, droplet size and spray parameters
- Analyze efficiency and performance of harvesting machinery

## TEXT BOOK:

1. Jain S C and Rai C R, "Farm Tractor Maintenance and Repair", Standard Publishers and Distributors, New Delhi, 3<sup>rd</sup> Edition, 2013
2. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publishers Distributors, New Delhi, 2020
3. Michael and Ohja, "Principles of Agricultural Engineering volume-1", Jain brothers, New Delhi, 14<sup>th</sup> Edition, 2021

## REFERENCES:

1. Black P O, "Diesel Engine Manual", D B Taraporevala Sons & Co Pvt Ltd, Mumbai, 1996
2. Kepner RA, "Principles of Farm Machinery", CBS Publishers and Distributors, New Delhi, Kindle Edition, 2018
3. Harris Pearson Smith, "Farm machinery and equipment", Tata McGraw-Hill publication, New Delhi, Kindle Edition, 2017

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	1	-	-	-	-	-	1
CO2	3	2	1	-	1	-	-	-	-	-	1
CO3	3	2	1	-	1	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	1

  
CHAIRMAN  
BoS (AGE)

**OBJECTIVES:**

The student should be made to:

- Understand the principles of biopotential generation and electrode interfaces
- Explore techniques for measuring bioelectrical signals
- Analyze signal conditioning circuits used in biomedical applications
- Examine instrumentation for non-electrical physiological measurements
- Investigate biochemical sensors and biosensing techniques

**UNIT I BIOPOTENTIAL ELECTRODES**

9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, half-cell potential, Contact impedance, polarization effects of electrode - non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

**UNIT II BIOPOTENTIAL MEASUREMENTS**

9

Bio signals characteristics - frequency and amplitude ranges. ECG - Einthoven's triangle, standard 12 lead system, Principles of vector cardiography. EEG- 10-20 electrode system, unipolar, bipolar and average mode. EMG-unipolar and bipolar mode. Recording of ERG, EOG and EGG.

**UNIT III SIGNAL CONDITIONING CIRCUITS**

9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers - transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering.

**UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS**

9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method. Electromagnetic and ultrasound blood flow measurement.

**UNIT V BIOCHEMICAL MEASUREMENT AND BIOSENSORS**

9

Biochemical sensors - pH, pO<sub>2</sub> and pCO<sub>2</sub>, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analysers - colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyser (simplified schematic description) - Bio Sensors - Principles - amperometry and voltametric techniques.

**TOTAL: 45 PERIODS**

Ashish K. T.  
Chairman  
BoS/BME

**OUTCOMES:**

On successful completion of this course, the student will be able to,

- Explain the origin of biopotentials and analyze the characteristics of various electrodes and their circuits
- Describe the methods for recording ECG, EEG, EMG, and other biosignals using standard electrode systems
- Design and evaluate bio-amplifier circuits and filtering techniques for accurate biosignal acquisition
- Compare methods for measuring temperature, blood pressure, and cardiac output using various technologies
- Demonstrate the working principles of biosensors and assess their applications in clinical diagnostics

**TEXT BOOK:**

1. Leslie Cromwell, —Biomedical Instrumentation and measurement|, 2nd edition, Prentice Hall of India, New Delhi, 2015.

**REFERENCES:**

1. John G. Webster, —Medical Instrumentation Application and Design|, 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technology|, Pearson Education, 2004.
3. Myer Kutz, —Standard Handbook of Biomedical Engineering and Design|, McGraw Hill Publisher, 2003.
4. Khandpur R.S. —Handbook of Biomedical Instrumentation|. 3rd edition. Tata McGraw-Hill New Delhi. 2014.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	-	1	2	-	-	-	1	-	2
<b>CO2</b>	3	2	1	1	3	-	-	-	2	-	2
<b>CO3</b>	3	2	3	2	3	-	-	-	2	1	2
<b>CO4</b>	3	3	2	2	3	2	-	-	2	1	2
<b>CO5</b>	3	2	2	2	3	3	2	-	2	1	3

  
Chairman  
BoS/BME

**OBJECTIVES:****The student should be made to:**

- Understand the role of food sources and microbiological safety in public health
- Explore the biochemical and physiological roles of macro and micronutrients
- Examine the applications of nanotechnology in food science
- Investigate nutritional disorders and energy balance in relation to diet planning
- Critically assess consumer perspectives and regulatory issues surrounding GM foods

**UNIT I FOOD AND MICROBIOLOGY OF HEALTH 9**

Food resources (plant, animal, microbes); Overview of current production systems; constraints and necessity of novel strategies. Functional and “Super” Foods - role in optimal nutrition. Sugar, protein and fat substitutes. Food and behaviour- physiological disturbances in alcoholism, drug abuse and smoking. Food Related Laws: Inspection – Microbial Indicators of product quality – Indicators of food safety – 229 Microbiological safety of foods - control strategies – Hazard Analysis Critical Point System (HACCP concept)- Microbiological criteria.

**UNIT II NUTRIENTS AND FOOD ADDITIVES 9**

Macro nutrients- carbohydrates, proteins and lipids. Micronutrients-Minerals: Calcium, Magnesium, Iron, Zinc, Copper and Selenium; Vitamins. Nutritional Physiology: Digestion, absorption, and utilization of major and minor nutrients. Biotechnology of food additives- Bioflavors and colors, microbial polysaccharides, recombinant enzymes in food sector.

**UNIT III NANO FOOD TECHNOLOGY 9**

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf-life assessment.

**UNIT IV FOOD RELATED NUTRITIONAL DISORDERS AND ENERGY CALCULATION 9**

Type I Disorders-Causes of life style and stress related diseases. Cardio-vascular diseases, hypertension, obesity. Type-II Disorders: Cancer, diabetics, ulcers, electrolyte and water imbalance. Health indices. Preventive and remedial measures. Energy balance and methods to calculate individual nutrient and energy needs. Planning a healthy diet.

**UNIT V CONSUMERS ON GM FOODS AND CONTEMPORARY ISSUES 9**

Global perspective of consumers on GM foods: Major concerns of transgenic, foods GM ingredients in food products. (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods, Case studies- GM foods.

**TOTAL:45 PERIODS****OUTCOMES:****On successful completion of this course, the student will be able to,**

- Identify various food resources and explain microbial indicators used in food safety and HACCP principles
- Analyze the digestion, absorption, and utilization of nutrients and evaluate the role of food additives
- Demonstrate knowledge of nano materials in food packaging and assess their impact on shelf-life and safety
- Diagnose common nutritional disorders and design balanced diets based on individual energy requirements
- Debate ethical concerns and interpret labeling and safety regulations related to GM food products

**TEXT BOOKS:**

1. P.J. Fellows.2009. Food Processing Technology -Principles and Practice (Third Edition). A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition.
2. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin. 2015. Food Biotechnology. CRC Press. Second edition.

**REFERENCES:**

1. Understanding Nutrition. 2010. Ellie Whitney, Sharon Rady Rolfes, 11e. Thompson Wadsworth.
2. Nutritional Sciences- From Fundamentals to Food.2013. Michelle McGuire, Kathy A. Beerman, second edition, Thompson Wadsworth.
3. Yasmine Motarjemi, Huub Lelieveld. Food Safety Management - A Practical Guide for the Food Industry (2014), 1st Edition, Academic Press, London, UK.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	2	2	3	2	-	2	1	2
CO2	3	3	2	2	2	2	-	-	2	1	2
CO3	3	2	3	2	3	3	2	-	2	1	3
CO4	3	3	3	2	2	2	-	-	2	2	3
CO5	2	2	1	1	1	3	3	2	3	2	3

  
Chairman  
BoS/BME

<b>24CE101OE</b>	<b>INDUSTRIAL WASTE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Understand the various characteristics of industrial waste water.
- Interpret the process and mechanism of different wastewater treatment process.
- Infer awareness on waste that emits from industries, waste minimization and clean technologies.
- Demonstrate biological waste water treatment process.
- Make use of treatment of sludge and its disposal methods.

**UNIT I INTRODUCTION 9**

Undesirable waste water characteristics – Characteristics of industrial waste waters – Waste water characteristics – Estimating the organic content – Measuring the efficiency toxicity – In plant waste control and waste reuse – Storm water control.

**UNIT II WASTE WATER TREATMENT PROCESSES 9**

Pre and primary treatment of waste water – Equalization – Neutralization – Sedimentation – Oil separation-sour water strippers – Floatation – Coagulation, precipitation and metals removal– coagulation – Heavy metals removal – Aeration and mass transfer; mechanism of oxygen transfer – Aeration equipment – Air stripping of volatile organic compounds.

**UNIT III POLLUTION FROM MAJOR INDUSTRIES 9**

Sources, Characteristics, waste treatment flow from industries such as Textiles, pulp and paper mill wastes breweries and distilleries waste, Tanneries, Pharmaceuticals, Dairy, Sugar mill wastes, Steel plants, oil Refineries, fertilizer plant waste, petrochemical complex waste, corn starch industry waste –Odour and its removal-removal color from waste waters – Waste minimization and clean technologies.



CHAIRMAN  
BoS (CIVIL)



24CE102OE

ECOLOGICAL ENGINEERING

L T P C

3 0 0 3

**OBJECTIVES:****The students should be made to:**

- Interpret Principles and Concepts of ecosystem
- Infer the function of ecosystem and its biochemical reaction
- Outline Rehabilitation of ecosystem through ecological Principles
- Organize ecological effects due to industrialization
- Examine the need for environmental sustainability with related case studies.

**UNIT I PRINCIPLES AND CONCEPTS 9**

Scope- applications of Ecological Engineering - Development - evolution of ecosystems - Principles - concepts pertaining to species - populations - community.

**UNIT II ECOSYSTEM FUNCTIONS 9**

Biological magnification - diversity - stability - immature - mature systems - Primary productivity - Biochemical cycling of nitrogen - phosphorous - sulphur - carbon dioxide - Habitat ecology - Terrestrial - fresh water - estuarine - marine habitats.

**UNIT III ECOLOGICAL ENGINEERING METHODS 9**

Bio monitoring - role in evaluation of aquatic ecosystem - Rehabilitation of ecosystems through ecological principles - Step cropping - bio-wind screens - Wetlands - ponds - Root Zone Treatment for wastewater - Reuse of treated wastewater through ecological systems - green building and Bio mimicry.

**UNIT IV ECOLOGICAL EFFECTS OF INDUSTRIALISATION 9**

Ecological effects of exploration – production- extraction – processing – manufacture - transport - Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods - Stacks Gravitational - Inertial Separation - Settling Chambers -Dynamic Separators - Cyclones - Filtration - Liquid Scrubbing - Electrostatic Precipitators.



CHAIRMAN  
BoS (CIVIL)

**UNIT V CASE STUDIES AND ENVIRONMENTAL SUSTAINABILITY 9**

Case studies of integrated ecological engineering systems - Planning -Measuring Sustainability - Carrying Capacity and its limits - Concept of Ecological Foot print.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Successful completion of this course, the students will be able to:**

- Explain the development and evolution of ecosystem.
- Summarize the structure and function of natural ecosystems and biological magnification.
- Utilize ecological engineering principles into sustainable Practices.
- Organize ecological effects of exploration and industrialization.
- Analyze integrated ecological engineering systems.

**TEXT BOOKS:**

1. Jainul Alam, “Ecological Engineering”, Discovery Publishing House, 2025
2. Geoff Gurr, Miguel A Altieri, Steve Wratten, “Ecological Engineering for Pest Management: Advances in Habitat Manipulation for Arthropods”, CABI Publishing, 2004.

**REFERENCES:**

1. Majeti Narasimha Vara Prasad, “Handbook of Ecological and Ecosystem Engineering”, Wiley; 1<sup>st</sup> edition,2021.
2. Theodore Sudia, “Ecological Engineering of the City: The Urban Ecosystem”, Forgotten Books, 2018
3. Patrick Kangas, “Ecological Engineering: Principles and Practice”, CRC Press Inc, 1<sup>st</sup> edition, 2003.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	2	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	2	2	-	-	-	-	-
CO4	2	2	-	-	2	-	-	-	-	-	-
CO5	2	2	-	-	-	3	-	-	-	-	-

  
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BoS (CIVIL)

24CS1010E PYTHON PROGRAMMING FOR DATA SCIENCE L T P C  
(Common to AGE, CIVIL, BME, ECE, EEE & 3 0 0 3  
MECH)

**OBJECTIVES:**

**The Student should be made to:**

- Familiarize with the data science work environment, including IPython and Jupyter.
- Learn the ndarray object for efficient storage and manipulation of dense data arrays in Python using NumPy.
- Explore the DataFrame object for handling labeled/columnar data in Python using Pandas.
- Perform data visualizations in Python using Matplotlib.
- Apply machine learning algorithms in Python using Scikit-Learn.

**UNIT I IPYTHON: BEYOND NORMAL PYTHON 9**

Shell and Notebook- Help and Documentation in IPython - Keyboard Shortcuts in the IPython Shell - IPython Magic Commands- Input and Output History - IPython and Shell Commands- Errors and Debugging- Profiling and Timing Code.

**UNIT II INTRODUCTION TO NUMPY 9**

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions – Aggregations - Computation on Arrays - Comparisons, Masks, and Boolean Logic - Fancy Indexing - Sorting Arrays - Structured Data.

**UNIT III DATA MANIPULATION WITH PANDAS 9**

Installing and Using Pandas- Introducing Pandas Objects- Data Indexing and Selection- Operating on Data in Pandas- Handling Missing Data - Hierarchical Indexing- Combining Datasets - Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series - High-Performance Pandas.

**UNIT IV VISUALIZATION WITH MATPLOTLIB 9**

General Matplotlib Tips - Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Matplotlib - Three-Dimensional Plotting in Matplotlib - Geographic Data with Basemap - Visualization with Seaborn.

  
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BoS (CSE)

**UNIT V MACHINE LEARNING WITH SCIKIT-LEARN****9**

Machine Learning - Introducing Scikit – Learn - Hyper parameters and Model Validation - Feature Engineering - Naive Bayes Classification - Linear Regression - Support Vector Machines - Decision Trees and Random Forests - Principal Component Analysis - k-Means Clustering - Gaussian Mixture Models - Application: A Face Detection Pipeline.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Leverage IPython and Jupyter for streamlined development and interactive data analysis.
- Utilize NumPy’s ndarray for optimized storage and manipulation of numerical data.
- Manage and analyze structured datasets effectively using Pandas DataFrame.
- Design clear and impactful data visualizations using Matplotlib in Python.
- Implement machine learning models in Python using Scikit-Learn for analytical problem-solving.

**TEXT BOOK:**

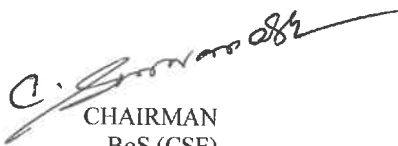
1. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, 2023.

**REFERENCE:**

1. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, 3<sup>rd</sup> Edition, O’Reilly, 2022.
2. John Paul Mueller, Luca Massaron, Wiley, “Python for data science for dummies”, 3<sup>rd</sup> Edition, 2023.

**COs – POs Mapping**

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	2	2	1	1	3	1	1	1	1	2	1
2	3	3	2	1	3	1	1	1	1	2	1
3	3	3	2	2	3	1	1	1	2	2	1
4	2	2	2	1	2	2	1	1	2	1	1
5	3	3	3	2	3	2	1	1	2	3	2

  
CHAIRMAN  
BoS (CSE)

29/10/15

24CS102OE	<b>PROGRAMMING AND DATA STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Common to AGE, CIVIL, BME, ECE, EEE &amp; MECH)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The Student should be made to:**

- Explain the basic concepts, syntax, and flow of C programming.
- Apply advanced features of C for problem-solving.
- Demonstrate the concepts and applications of linear data structures.
- Analyze the representation and use of non-linear data structures.
- Illustrate fundamental techniques in searching, sorting, and hashing.

**UNIT I C PROGRAMMING BASICS 9**

Structure of C program - Data Types - Storage classes – Variables - Constants - Keywords - Operators - Input/output statements, Assignment statements - Decision making statements - Switch statement - Looping statements - Introduction to Arrays: Declaration, Initialization - One dimensional array - Two dimensional arrays.

**UNI II FUNCTIONS, POINTERS AND STRUCTURES 9**

Introduction to functions: Function prototype, function definition, function call, Recursion - Pointers - Pointer operators - Pointer arithmetic - Array of pointers - Parameter passing: Pass by value, Pass by reference. Structure - Nested structures - Pointer and Structures - Array of structures - Self-referential structures - Dynamic memory allocation.

**UNIT III LINEAR DATA STRUCTURES 9**

List - Singly Linked lists - Application of List - Polynomial addition - Linked list implementation of Stacks - Applications of Stack - Evaluating arithmetic expressions - Linked list implementation of Queues - Application of Queue.

**UNIT IV NON-LINEAR DATA STRUCTURES 9**

Trees - Binary Trees - Binary tree representation and traversals - Binary Search Trees - Applications of trees. Graph and its representations - Graph Traversals - Topological Sort - Applications of graphs.

  
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BoS (CSE)

**UNIT V      SEARCHING, SORTING AND HASH TABLE**

9

Linear Search - Binary Search. Bubble Sort - Insertion sort - Merge sort - Quick sort - Hashing functions - Hash tables - Introduction to Overflow handling.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Construct programs using the fundamental concepts of C programming.
- Employ advanced features of C to solve computational problems.
- Select and apply appropriate linear data structures for effective problem solving.
- Design and implement non-linear data structures such as trees and graphs for application development.
- Evaluate and compare various searching, sorting algorithms, and hashing techniques.

**TEXTBOOK:**

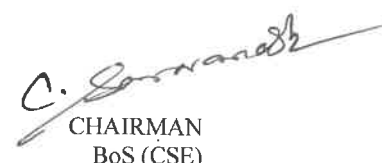
1. Reema Thareja, “Data Structures Using C”, Third Edition, Oxford University Press, 2023.

**REFERENCES:**

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Fourth Edition, Pearson Education, 2013.

**COs - POs Mapping**

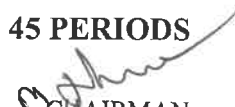
COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	2	2	1	-	-	-	1	1	1
2	3	2	3	2	2	-	-	-	1	1	1
3	3	3	3	3	2	-	-	-	1	1	1
4	3	3	3	3	2	-	-	-	1	1	1
5	3	3	3	3	2	-	-	-	1	1	1

  
CHAIRMAN  
BoS (CSE)

**OBJECTIVES:****The Student should be made to:**

- Understand the basics of signals and systems as a foundation for all engineering-related courses.
- Analyze the fundamental characteristics of Linear Time-Invariant (LTI) systems.
- Gain knowledge of signal transmission requirements and system bandwidth considerations.
- Learn the statistical properties of signals, including correlation and power spectrum concepts.
- Acquire knowledge of noise sources, their characteristics, and impact on system performance.

<b>UNIT I</b>	<b>SIGNAL ANALYSIS</b>	<b>9</b>
Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.		
<b>UNIT II</b>	<b>SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS LINEAR SYSTEM</b>	<b>9</b>
Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.		
<b>UNIT III</b>	<b>SAMPLING THEOREM</b>	<b>9</b>
Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.		
<b>UNIT IV</b>	<b>TEMPORAL CHARACTERISTICS OF SIGNALS</b>	<b>9</b>
Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Time Averages and Ergodicity, Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Cross-Correlation Function and Its Properties, Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function.		
<b>UNIT V</b>	<b>NOISE SOURCES</b>	<b>9</b>
Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.		

**TOTAL: 45 PERIODS**
  
 CHAIRMAN  
 BoS (ECE)

**OUTCOMES:**

On successful completion of this course, the students will be able to,

Understand how to solve the given standard partial differential equations.

- Explain the fundamental concepts of signals, systems, and standard signal functions.
- Apply orthogonal functions, convolution, and correlation techniques to analyze system responses.
- Analyze the characteristics and behavior of Linear Time-Invariant (LTI) systems in time and frequency domains.
- Interpret temporal and statistical properties of signals, including correlation, ergodicity, and power spectral density.
- Identify various noise sources such as thermal, resistive, and arbitrary noise.

**TEXT BOOKS:**

1. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, Reprint 2017
2. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Ed., 2001.

**REFERENCES :**

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems," 2nd Ed., Pearson Prentice Hall, 2008.
2. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
3. Random Processes for Engineers-Bruce Hajck, Cambridge unipress, 2015
4. Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications, 2003

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	1	2
CO2	3	3	2	2	1	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	2
CO4	2	3	-	3	2	-	-	-	-	-	2
CO5	3	2	-	2	1	2	-	-	-	-	2

  
CHAIRMAN  
BoS (ECE)

24EC102OE

## CONSUMER ELECTRONICS

L T P C

3 0 0 3

**OBJECTIVES:****The student should be made to:**

- Gain knowledge of semiconductor devices, logic circuits, and microcontrollers used in consumer electronics.
- Understand the construction and working of audio, video, and display systems in entertainment electronics.
- Familiarize with the technology and functionality of modern home appliances.
- Learn the concepts, sensors, and technologies involved in smart home automation and security.
- Explore the fundamentals of communication systems and recent advancements such as IoT, Li-Fi, and GPS.

**UNIT I ELECTRONIC FUNDAMENTALS 9**

Semiconductor Devices: Diodes, Transistors, Logic gates, Integrated Circuits, -Moor's law, ADC ,DAC, Introduction about Microcontroller, microcontroller in consumer electronics.

**UNIT II ENTERTAINMENT ELECTRONICS 9**

Audio systems: Construction and working principle of Amplifier, Microphone, Home Theater-Display Systems: CRT, LCD, LED. Video Players: DVD and blue ray. Camera and camcorders.

**UNIT III HOME APPLIANCES 9**

Home Enablement Systems - RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Microwave Oven, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks


**UNIT IV SMART HOME 9**

Technology involved in Smart home, Home Virtual Assistants-Alexa and Google Home, Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

**UNIT V COMMUNICATION SYSTEMS 9**

Cordless Telephones, Fax Machines, PDAs-Tablets, Smart Phones and Smart Watches, Introduction to Smart OS-Android and iOS, Video Conferencing Systems-Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (ECE)

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the working principles of semiconductor devices, logic circuits, and microcontrollers in electronic systems.
- Describe the operation of entertainment electronics such as amplifiers, microphones, home theaters, display systems, and video players.
- Identify and explain the technologies used in home appliances including smart refrigerators, induction stoves, and cleaning robots.
- Analyze the technologies and sensors used in smart home systems, virtual assistants, and home security.
- Summarize the working principles of communication systems and discuss the role of IoT, GPS, Wi-Fi, and Li-Fi in modern consumer electronics.

## TEXT BOOKS:

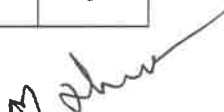
1. Bali S P, Consumer Electronics, Pearson Education Asia Pvt. Ltd., 2008
2. Mitchel E Schultz, Basic Electronics, McGraw Hill Publishers, Tenth Edition, 2017.

## REFERENCES:

1. Thomas L Floyd, Electronic Devices, Pearson Education Asia, Tenth Edition, 2018
2. Philp Hoff, Consumer Electronics for Engineers, Cambridge University Press, 1998.
3. Jordan Frith, Smartphones as Locative Media, John Wiley, 2014.
4. Dennis C Brewer, Home Automation Made Easy, Que Publishing, 2013.
5. Thomas M Coughlin, Digital Storage in Consumer Electronics, Springer, 2017.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	1	2
CO2	3	2	-	-	2	-	-	-	-	1	2
CO3	2	2	1	-	2	2	2	-	-	-	2
CO4	2	3	2	2	3	2	2	-	-	-	2
CO5	3	3	2	2	3	2	2	-	-	1	3

  
CHAIRMAN  
BoS (ECE)

**OBJECTIVES:****The student should be made to:**

- Study the classification, properties and applications of engineering materials.
- Provide knowledge of various metal casting processes, equipment and defect analysis.
- Explain the principles and applications of welding, soldering, and brazing processes.
- Familiarize with the basic machining operations of the lathe and various machine tool functions.
- Understand the concepts of Computer Numerical Control (CNC) machine tool.

**UNIT I ENGINEERING MATERIALS****9**

Engineering Materials – Classification - Mechanical properties of materials - strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability – Steels and cast irons: Carbon steels, classification based on percentage of carbon as low, medium and high carbon steel – properties and applications. Wrought iron, cast iron – Alloy steels: Stainless steel, tool steel.

**UNIT II METAL CASTING PROCESSES****9**

Sand Casting : Sand mould – Type of patterns - Pattern materials – Pattern allowances – Moulding sand properties – Core – Moulding machines – Types and applications; Melting furnaces : Blast and Cupola furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal casting – Stir casting; Defects in sand casting.

**UNIT III WELDING****9**

Introduction, classification of welding processes – Gas welding, types of flames and applications – Electric arc welding – Resistance welding – Soldering and Brazing processes and their uses.

**UNIT IV MACHINING****9**

Basic principles of lathe – Machine and operations performed on it - Basic description of machines and operations of Shaper, Drilling, Milling and Grinding.

**UNIT V CNC MACHINE****9**

Numerical control (NC) machine tools – CNC: types, constitutional details, special features – design considerations of CNC machines for improving machining accuracy - Structural members - Slide ways - Linear bearings - Ball screws - Spindle drives and feed drives.

**TOTAL: 45 PERIODS**

CHAIRMAN  
(BoS / MECH) 25/10/25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Classify engineering materials based on their properties and applications.
- Explain various metal casting processes, associated equipment and analyze casting defects.
- Apply the principles of welding, soldering and brazing processes in suitable applications.
- Perform basic machining operations using machine tools such as lathe, shaping, drilling, milling, and grinding.
- Explain the concepts and operations of Computer Numerical Control (CNC) machine tools for customized operations

**TEXT BOOKS:**

1. Kalpakjian and Schmid ,“Manufacturing Engineering and Technology”, Pearson Education India, 7<sup>th</sup> Edition, 2014
2. Hajra Choudry S.K, “Elements of Workshop Technology - Vol II”, Media promoters & publishers Pvt. Ltd, 13<sup>th</sup> Edition, 2010

**REFERENCES:**

1. Jain R.K., “Production Technology: Manufacturing Processes, Technology and Automation”, Khanna publication India, 17<sup>th</sup> Edition , 2011
2. P N Rao, Manufacturing technology, Volume I, Foundry, Forming and Welding, McGraw Hill Education (India) Private Limited, 5<sup>th</sup> Edition , 2018
3. P N Rao, Manufacturing technology, Volume II, Metal Cutting and Machine Tools, McGraw Hill Education (India) Private Limited, 4<sup>th</sup> Edition , 2018

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	-	-	1
CO2	2	2	-	-	-	-	-	-	-	-	1
CO3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	2	-	-	-	-	-	-	-	-	1
CO5	2	2	1	1	2	-	-	-	-	-	1

  
CHAIRMAN  
(BoS / MECH)

**OBJECTIVES:****The student should be made to:**

- Understand various conventional and non-conventional energy sources.
- Learn liquid fuel production processes from coal and related resources.
- Gain knowledge on the working principles and types of fuel cells.
- Identify the processes, properties, and applications of biodiesel.
- Study about electricity generation from nuclear energy.

**UNIT I INTRODUCTION TO ENERGY****9**

World energy consumption – petroleum – natural gas – coal – nuclear energy – geothermal energy – renewable energy - solar, wind, tidal, biomass and hydropower.

**UNIT II LIQUID FUELS****9**

Introduction to coal pyrolysis – char oil energy development process – TOSCOAL process – Lurgi-Ruhr gas process – Occidental flash pyrolysis process – Clean coke process – Coalcon process.

**UNIT III FUEL CELLS****9**

Introduction – basic concepts – design characteristics – operation – thermal efficiency – cell voltage – fuel cell system – general description – fuel cell classifications – low temperature fuel cells - proton exchange membrane fuel cells and alkaline fuel cells – high temperature fuel cells - molten carbonate fuel cells and solid oxide fuel cells.

**UNIT IV BIODIESEL****9**

Introduction – transesterification process for biodiesel manufacture – pretreatment of oil – transesterification reaction in a biodiesel reactor – product and by-product separation – purification – properties of biodiesel – cetane number – calorific value – general physical properties of biodiesel – cold flow properties – material compatibility.

**UNIT V NUCLEAR ENERGY****9**

Nuclear fission and nuclear reactor physics – electricity generation from nuclear reactors – nuclear fuel cycle – types of reactors – advanced reactors and concepts – hydrogen production – nuclear waste disposal – nuclear fusion.

**TOTAL: 45 PERIODS**

CHAIRMAN  
(BoS / MECH)

28/10/25

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Classify various conventional and non-conventional energy resources.
- Understand the different coal-based liquid fuel production processes.
- Explain design and working of different fuel cells.
- Use biodiesel with various blends to evaluate its fuel properties.
- Utilize the nuclear reactors and related energy technologies for sustainable developments.

**TEXT BOOKS:**

1. Sunggyu Lee, James G Speight, “Handbook of Alternative Fuel Technologies”, CRC Press, Taylor & Francis Group, 2014.
2. Arumugam S Ramadhas, “Alternative Fuels for Transportation”, Taylor & Francis, 2016.

**REFERENCES:**

1. Donald L Klass, “Biomass for Renewable Energy, Fuels and Chemicals”, Elsevier-Academic Press, 1st Edition.
2. Sunggyu Lee, “Alternative Fuels”, CRC Press, Taylor & Francis, 1st Edition.
3. Suresh M, Rajkumar S, Lakshminarayanan A K, “Alternative Energy Sources, Materials and Technologies”, Trans Tech Publications Limited, 2015.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	2	-	-	-	-	-
CO4	2	2	-	-	-	2	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-

  
CHAIRMAN  
(BoS / MECH)



**UNIT V PROJECT MANAGEMENT****9**

Software Project Management - Software Configuration Management - Project Scheduling - DevOps: Motivation - Cloud as a Platform - Operations - Deployment Pipeline: Overall Architecture Building and Testing - Deployment - Tools - Case Study.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Compare and select appropriate Software Development Lifecycle Models
- Evaluate project management approaches as well as cost and schedule estimation strategies.
- Perform formal analysis on software specification.
- Use UML diagrams effectively for system analysis and design.
- Design software systems using architectural styles and design patterns.

**TEXT BOOKS:**

1. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, 1<sup>st</sup> Edition, McGraw-Hill, 2014.
2. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: Using UML, Patterns and Java. 3<sup>rd</sup> Edition, Pearson Education, 2009.

**REFERENCES:**

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2<sup>nd</sup> Edition, PHI Learning Pvt. Ltd., 2010.
2. Len Bass, Ingo Weber and Liming Zhu, - DevOps: A Software Architect's Perspective, Pearson Education, 2016.
3. Rajib Mall, Fundamentals of Software Engineering, 3<sup>rd</sup> Edition, PHI Learning Pvt. Ltd., 2009.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	2	2	1	2	2	-	-	-	1	1	2
2	3	3	2	3	2	-	-	-	2	3	2
3	3	3	2	2	1	-	-	-	2	3	2
4	2	3	2	1	3	-	-	-	2	3	2
5	2	3	1	1	2	-	-	-	-	-	1



CHAIRMAN  
BoS (IT)

**OBJECTIVES:****The Student should be made to:**

- Understand the concepts of wireless sensor networks.
- Get exposure on WSN environment.
- Know the layered approach in sensor networks.
- Understand the use of suitable protocol for WSN.
- Explore knowledge on performance analysis of WSN.

**UNIT I INTRODUCTION TO WIRELESS SENSOR NETWORKS 9**

Data Communications - Networks - Networks Types - Network Models: TCP/IP Protocol suite - The OSI Model. Digital-to-Digital Conversion: Line coding - Line Coding Schemes - Transmission Modes - Transmission media: Guided - Unguided media.

**UNIT II WSN ARCHITECTURE 9**

Data Dissemination - Flooding and Gossiping - Data Gathering Sensor Network Scenarios - Optimization Goals and Figures of Merit - Design Principles for WSNs - Gateway Concepts - Need for Gateway - WSN and Internet Communication - WSN Tunneling.

**UNIT III MEDIA ACCESS CONTROL 9**


Fundamentals of MAC protocols - Low Duty Cycle Protocols and Wakeup Concepts - Contention Based Protocols - Schedule-based Protocols - SMAC - BMAC - Traffic - Adaptive Medium Access Protocol - IEEE 802.15.4 MAC Protocol.

**UNIT IV TRANSPORT LAYER 9**

Circuit Switching - Packet Switching - Concept of IPV4 - IPV6 - 6LOWPAN and IP - IP based WSN - 6LOWPAN based WSN - IOT.

**UNIT V TOOLS FOR WSN 9**

TinyOS: Introduction - NesC - Interfaces - Modules - Configuration - Programming in TinyOS using NesC - TOSSIM - Contiki - Structure - Communication Stack - Simulation environment - Cooja simulator - Programming.

**TOTAL: 45 PERIODS**  
CHAIRMAN  
BoS (IT)

**OUTCOMES:****On successful completion of this course, the students will be able to,**

- Explore the fundamentals of wireless sensor network models.
- Explore knowledge in devising layers in WSN.
- Able to design energy efficient WSNs.
- Design application dependent suitable for infrastructure-less networks.
- Implement various protocols in TinyOS and Contiki.

**TEXT BOOKS:**

1. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks. 1<sup>st</sup> Edition, John Wiley & Sons, New Jersey, 2011.
2. Jun Zheng, Abbas Jamalipour, Wireless Sensor Networks: A Networking Perspective. 1<sup>st</sup> Edition, Wiley-IEEE Press, 2014.

**REFERENCES:**

1. Walteneus W. Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice. 1<sup>st</sup> Edition, John Wiley & Sons, 2014.
2. Ian F. Akyildiz, Mehmet Can Vuran, Wireless Sensor Networks. 1<sup>st</sup> Edition, John Wiley & Sons, 2011.
3. Zach Shelby, Carsten Bormann, 6LoWPAN: The Wireless Embedded Internet. 1<sup>st</sup> Edition, John Wiley & Sons, 2009.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	3	2	-	-	-	-	-	-	-
2	3	2	3	2	-	3	-	-	-	-	-
3	3	3	3	3	-	3	3	-	2	2	-
4	3	3	3	3	-	3	3	3	2	2	2
5	3	3	3	3	3	3	-	-	2	2	-



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BoS (IT)

24AD2010E

**BASICS OF VISUALIZATION TOOLS**  
(COMMON TO AGE, BME, CIVIL, EEE, ECE AND MECH)

L T P C

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**OBJECTIVES:**

**The student should be made to:**

- Gain a comprehensive understanding of the core concepts in data visualization
- Learn the operational principles of different information visualization tools
- Identify and address common issues encountered in data representation
- Master the use of Tableau for effective data visualization
- Develop expertise in creating real-time, interactive visualization systems

**UNIT I INTRODUCTION**

9

Context of data visualization - Definition, Methodology, Visualization design objectives - Key Factors - Purpose, visualization function and tone, visualization design options - Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tool - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs

**UNIT II VISUALIZATION TECHNIQUES FOR TIME-SERIES, TREES & GRAPHS**

9

Mapping - Time series - Connections and correlations - Indicator-Area chart - Pivot table - Scatter charts, Scatter maps - Tree maps, Space filling and non-space filling methods - Hierarchies and Recursion - Networks and Graphs - Displaying Arbitrary Graphs-node link graph - Matrix representation for graphs - Info graphics

**UNIT III TEXT AND DOCUMENT VISUALIZATION**

9

Acquiring data - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Web Techniques, Parsing data - Levels of Effort, Tools for Gathering Clues, Text Markup Languages, Regular Expressions, Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

**UNIT IV INTERACTIVE DATA VISUALIZATION**

9

Drawing with data - Scales - Axes - Updates, Transition and Motion - Interactivity - Layouts - Geo-mapping - Exporting, Framework - D3.js, Tableau Dashboards.

**UNIT V SECURITY IN DATA VISUALIZATION**

9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization - Attacking and defending visualization systems - Creating secured visualization system.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

  
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**BoS (AD)**

**On successful completion of this course, the students will be able to,**

- Apply mathematics and basic science knowledge for designing information visualizing System
- Collect data ethically and solve engineering problem in visualizing the information.
- Implement algorithms and techniques for interactive information visualization
- Conduct experiments by applying various modern visualization tool and solve the space layout problem
- Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams

**TEXT BOOKS:**

1. Robert Spence, “Information Visualization an Introduction”, Third Edition, Pearson Education, 2014.
2. Colin Ware, “Information Visualization Perception for Design”, Third edition, Morgan Kaufmann Publishers, 2012.
3. Robert Spence, “Information Visualization Design for Interaction”, Second Edition, Pearson Education, 2006.
4. Benjamin B. Bederson and Ben Shneiderman, “The Craft of Information Visualization”, Morgan Kaufmann Publishers, 2003.

**REFERENCES:**

1. Thomas Strothotte, “Computational Visualization: Graphics, Abstraction and Interactivity” , Springer, 1998.
2. Matthew O. Ward, George Grinstein, Daniel Keim, “Interactive Data Visualization: Foundation, Techniques and Applications” , Second Edition, A. K. Peters/CRC Press, 2015.
3. Joerg Osarek, “Virtual Reality Analytics” , Gordon’ s Arcade, 2016.

**Mapping of COs with POs:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	3	1	-	1	2	2	2
CO2	2	3	3	2	3	3	-	2	2	3	2
CO3	3	3	3	3	3	2	-	1	2	2	2
CO4	3	3	3	3	3	2	-	2	2	1	3
CO5	3	3	2	2	3	2	-	3	3	2	3

  
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**OBJECTIVES:**

**The Student should be made to:**

- Understand mathematical foundations relevant to machine learning (linear algebra, statistics, VC dimension, PAC learning)
- Grasp different supervised learning algorithms, their assumptions, strengths, and weaknesses
- Learn how ensemble methods and unsupervised learning work and when they are useful
- Understand neural networks in depth: from basic architecture to deep learning practices, and the challenges involved
- Design, perform, and analyse machine learning experiments properly, including model evaluation and statistical comparison

**UNIT I                      INTRODUCTION TO MACHINE LEARNING                      9**

Review of Linear Algebra for machine learning - Introduction and motivation for machine learning - Examples of machine learning applications - Vapnik-Chervonenkis (VC) dimension - Probably Approximately Correct (PAC) learning - Hypothesis spaces - Inductive bias - Generalization - Bias-variance trade-off.

**UNIT II                      SUPERVISED LEARNING                      9**

Linear Regression Models - Least squares, single & multiple variables - Bayesian linear regression - gradient descent. Linear Classification Models: Discriminant function - Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model - Naive Bayes - Maximum margin classifier - Support vector machine - Decision Tree - Random Forests.

**UNIT III                      ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING                      9**

Combining multiple learners - model combination schemes, voting - Ensemble Learning - bagging, boosting, stacking - Unsupervised learning: K-means; Instance Based Learning: KNN - Gaussian mixture models and Expectation maximization.

**UNIT IV                      NEURAL NETWORKS                      9**

Multilayer perceptron - activation functions - network training - gradient descent optimization - stochastic gradient descent - error backpropagation from shallow networks to deep networks - Unit saturation (aka the vanishing gradient problem) - ReLU - hyperparameter tuning - batch normalization - regularization; dropout.

  
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## UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments; Cross Validation (CV) and resampling - K-fold CV, bootstrapping - measuring classifier performance - assessing a single classification algorithm and comparing two classification algorithms -  $t$  test, McNemar's test, K-fold CV paired  $t$  test.

**TOTAL: 45 PERIODS**

### OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the concepts of hypothesis spaces, inductive bias, generalization, and bias-variance trade-off in machine learning.
- Implement linear regression, logistic regression, SVM, decision trees, and random forests, and evaluate their performance.
- Apply unsupervised learning techniques like K-means and Gaussian mixture models and use ensemble methods (bagging, boosting, stacking).
- Design neural network models, tune hyperparameters, apply regularization methods, and handle training issues like vanishing gradients.
- Plan and conduct experiments using cross-validation, bootstrapping; compare classifier performance using statistical tests like  $t$  test and McNemar's test.

### TEXT BOOK:

1. Tom M. Mitchell, "Machine Learning", First Edition, McGraw-Hill Education, Latest Reprint 2023.

### REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning", Fourth Edition, MIT Press, 2020.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", 2nd Edition, MIT Press, 2023.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Third Edition, O'Reilly Media, 2023.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2023 (Corrected reprint).
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, Latest Reprint 2024.

### Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	2	1	2	1	2	2
CO2	2	3	3	3	2	2	1	2	1	2	2
CO3	2	3	3	3	2	2	2	2	2	2	2
CO4	2	2	3	3	2	1	2	2	2	2	1
CO5	1	2	2	2	3	1	2	2	2	2	1

  
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BoS (AD)

**OBJECTIVES:****The student should be made to:**

- Explain the basic concepts, principles and components of organic farming
- Demonstrate the use of organic nutrient sources
- Implement organic pest and disease management using botanical pesticides
- Compare crop management practices in organic and conventional farming
- Evaluate quality standards, certification and marketing of organic products

**UNIT I INTRODUCTION TO ORGANIC FARMING 9**

Organic farming: Introduction – Concepts and principles of organic farming – Components of organic farming – Types of farming – Cropping systems and its types.

**UNIT II SOURCES OF NUTRIENTS IN ORGANIC FARMING 9**

Input management; Organic manure – FYM / Rural compost and city composts – Oil cakes – Animal wastes – Vermicompost – Green manure – Green leaf manure – Other nitrogen contributing plants – Biofertilizers.

**UNIT III ORGANIC PEST AND DISEASE MANAGEMENT 9**

Different types of pests and their classification – Botanical pesticides and its types – Integrated pest management – Inorganic pesticides, disadvantages of their use – Control of pests and diseases of important crops / vegetables.

**UNIT IV ORGANIC CROP MANAGEMENT 9**

Introduction to organic crop management – Organic vegetable crop management – Organic field crop management – Organic plantation crop management – Organic meat production.

**UNIT V QUALITY OF ORGANIC PRODUCTS 9**

Quality of organic food – Natural resources of antioxidants for health care – Antioxidants capacity of fruits and vegetables – Organic food and Human health – Organic standards – Organic certification process – Operation structure of organic certification – Marketing of organic products.

**TOTAL: 45 PERIODS**


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BoS (AGE)

28.10.25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Understand the principles of organic farming for sustainable agriculture
- Apply organic nutrients for sustainable crop production
- Implement organic pest and disease management using botanical pesticides and IPM approaches
- Analyze and compare organic crop and livestock management practices
- Evaluate organic food quality and certification for health and sustainability

**TEXTBOOKS:**

1. Sharma A, "Hand book of Organic Farming", Agrobios, 2016
2. Somasundram E D, Udhaya Nandhini and Meyappan M, "Principles of Organic farming (Theory and Practical)", CRC press, 1<sup>st</sup> Edition, 2021

**REFERENCES:**

1. Gupta S K, "Organic vegetable production", Rajat Publications, New Delhi, 2008
2. Singh S K, R B Yadav, Jagdish singh and Bijendra singh, "Organic Farming in Vegetables", ICAR Technical Publication, New Delhi, 2017

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	1	-	-	-	-	1
CO2	2	2	-	-	-	1	-	-	-	-	1
CO3	2	2	-	-	-	1	-	-	-	-	1
CO4	2	2	-	-	-	1	-	-	-	-	1
CO5	2	2	-	-	-	1	-	-	-	-	1

  
CHAIRMAN  
BoS (AGE)

24AG2020E INTRODUCTION TO GREEN HOUSE TECHNOLOGY L T P C  
3 0 0 3

**OBJECTIVES:**

The student should be made to:

- Know the importance, types and uses of greenhouses
- Use land survey and foundation methods in greenhouse design
- Practice installation of greenhouse structures and coverings
- Check and analyze maintenance needs of greenhouse structures
- Evaluate safety measures and emergency procedures in greenhouse operation

**UNIT I GENERAL CONCEPTS OF GREEN HOUSE 9**

Introduction to green house – Scope and Importance – Types of Green houses – Potential crop for green house.

**UNIT II GREEN HOUSE DESIGN AND LAYOUT 9**

Land survey and levelling – Assessment of structural strength, foundation specifications.

**UNIT III INSTALLATION OF GREEN HOUSE 9**

Erection of greenhouse structures – Covering with nets and shades – Types of glazing material and its characteristics – Checking of gutters.

**UNIT IV MAINTENANCE OF GREEN HOUSE 9**

Maintenance of erected structures – Maintenance of operational elements of the greenhouse for periodic checking, tightening, greasing etc.

**UNIT V HEALTH AND SAFETY 9**

Understanding about basic safety checks – Operation of all machinery and vehicles and hazards – Render appropriate emergency procedures.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain the scope, importance, types of greenhouses and their suitable crops
- Apply foundation principles for greenhouse design and layout
- Demonstrate installation of greenhouse structures, including glazing, nets and shades
- Analyze maintenance needs of greenhouse structures and operations for efficiency
- Evaluate safety measures and emergency procedures in greenhouse management



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28.10.25

**TEXTBOOKS:**

1. Prasad S and Kumar U, "Greenhouse Management of Horticultural Crops, Agrobios, 2<sup>nd</sup> Edition", 2010
2. Bose T K and Som G M, "Vegetable Crops in India", Naya Prokash, Kolkata, 1986

**REFERENCES:**

1. Roger Marshall, "The Greenhouse Gardener's Manual", Timber press, 2014

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	2	1	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	1	-	-	-	-	1



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BoS (AGE)

**OBJECTIVES:****The student should be made to:**

- Understand the historical and cultural significance of food in human societies
- Compare traditional and modern food processing techniques
- Explore regional food patterns and their transformation
- Examine commercial production and marketing of traditional foods
- Assess the health and environmental impacts of traditional foods

**UNIT I HISTORICAL AND CULTURAL PERSPECTIVES**

9

Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols: importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

**UNIT II TRADITIONAL METHODS OF FOOD PROCESSING**

9

Traditional methods of milling grains – rice, wheat and corn – equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sundrying, osmotic drying, brining, pickling and smoking.

**UNIT III TRADITIONAL FOOD PATTERNS**

9

Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods.

**UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS**

9

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover: role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

**UNIT V HEALTH ASPECTS OF TRADITIONAL FOODS**

9

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments / illnesses.

**TOTAL: 45 PERIODS****OUTCOMES:****On successful completion of this course, the student will be able to,**

- Describe the evolution of food production systems and explain the cultural symbolism of food across contexts
- Analyze traditional methods of milling, oil extraction, and preservation, and evaluate their efficiency
- Identify traditional food items from various Indian regions and assess their globalization and IPR concerns

*Ashok T.*  
Chairman  
BoS/BME

- Illustrate the role of SHGs, SMEs, and corporations in scaling traditional food products for mass markets
- Compare traditional and fast foods in terms of nutrition, safety, and sustainability; recommend healthier options

**TEXT BOOKS:**

1. Sen, Colleen Taylor “Food Culture in India” Greenwood Press, 2005.
2. Davidar, Ruth N. “Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	1	3	2	-	2	1	2
CO2	3	3	2	2	2	2	-	-	2	1	2
CO3	2	2	2	1	2	3	3	-	2	2	3
CO4	2	2	3	2	2	3	2	2	3	3	3
CO5	3	3	2	2	2	3	2	-	3	2	3

*Ashtak*  
 Chairman  
 BoS/BME

**OBJECTIVES:**

The student should be made to:

- Understand the structural and evolutionary aspects of cells and microorganisms
- Explore the molecular organization and functions of cellular organelles
- Examine membrane structure and transport mechanisms
- Investigate the cell cycle and mechanisms of cellular communication
- Apply the central dogma and scientific reporting techniques

**UNIT I INTRODUCTION TO CELL**

9

Cell, cell wall and Extracellular Matrix (ECM). composition, cellular dimensions, Evolution, Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria, mycoplasma and prions.

**UNIT II CELL ORGANELLES**

9

Molecular organisation, biogenesis and function Mitochondria, endoplasmic reticulum, Golgi apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.

**UNIT III BIO-MEMBRANE TRANSPORT**

9

Physiochemical properties of cell membranes. Molecular constitute of membranes, asymmetrical organisation of lipids and proteins. Solute transport across membrane's-fick's law. simple diffusion, passive-facilitated diffusion, active transport- primary and secondary, group translocation, transport ATPases, membrane transport in bacteria and animals. Transport mechanism- mobile carriers and pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell respiration.

**UNIT IV CELL CYCLE**

9

Cell cycle- Cell division by mitosis and meiosis. Comparison of meiosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signalling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.

**UNIT V CENTRAL DOGMA**

9

Overview of Central dogma DNA replication: Meselson & Stahl experiment, bi-directional Proof reading a report – Avoiding Typographical Errors – Bibliography in required Format – Font – Spacing – Checking Tables and Illustrations – Presenting a Report Orally – Techniques.

**TOTAL:45 PERIODS**

**OUTCOMES:**

On successful completion of this course, the student will be able to,

- Differentiate between prokaryotic and eukaryotic cells and classify viruses, bacteria, and prions.
- Describe the biogenesis and roles of organelles and explain the concept of compartmentalization.
- Analyze membrane composition and compare various transport processes including diffusion and active transport.
- Illustrate stages of mitosis and meiosis, and explain cell signalling, adhesion, and checkpoint regulation.
- Explain DNA replication and demonstrate skills in scientific documentation and oral presentation

**REFERENCES:**

1. Gerson and Gerson - Technical Communication: Process and Product. 7th Edition, Prentice Hall (2012)
2. Virendra K. Pamecha - Guide to Project Reports, Project Appraisals and Project Finance (2012)
3. Daniel Riordan - Technical Report Writing Today (1998)
4. Darla-Jean Weatherford - Technical Writing for Engineering Professionals (2016) Penwell Publishers

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	3	1	2	2	2	-	-	2	1	2
<b>CO2</b>	3	2	2	2	2	2	-	-	2	1	2
<b>CO3</b>	3	3	2	2	3	2	-	-	2	1	2
<b>CO4</b>	3	3	2	3	2	2	-	-	2	1	2
<b>CO5</b>	3	2	2	2	2	2	-	-	3	2	3

  
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BoS/BME

<b>24CE201OE</b>	<b>GLOBAL WARMING AND CLIMATE CHANGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The students should be made to:**

- Understand earth system and climate change impact.
- Infer basics of climate parameters and climate change causing elements
- Interpret atmosphere with its composition.
- Develop impact of climate change on various sectors.
- Make use of weather and climate parameters measuring instruments.

**UNIT I CLIMATOLOGY 9**

Introduction to earth system - Hydrosphere - lithosphere - cryosphere - atmosphere and biosphere - Climatology - Climate change impact in different sectors - Climate change mitigations and adaptations - Climate change negotiations - Earth system - hydrological cycle and carbon cycle - Paleoclimatology - Agriculture - Climate change Organization and programmes - Mitigation measures

**UNIT II CLIMATOLOGY PROXIES 9**

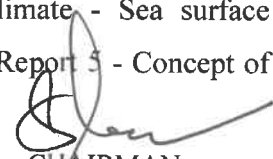
Earth system- cryosphere and biosphere - Climatology proxies - Forestry – IPCC - Intergovernmental Panel on Climate Change and assessment report highlights - Use of renewable resources- solar energy- Importance of earth system and climate - Indian climate system and their classification - Fishery - IPCC Assessment Report 1- Wind energy

**UNIT III ATMOSPHERE AND ITS COMPOSITION 9**

Atmosphere and its composition - Role of land and ocean to regulate climate- Socio economic impact – tourism - IPCC Assessment Report 2- different strata of atmosphere and temperature profile - Role of ice and wind to regulate climate - industries and business - IPCC Assessment Report

**UNIT IV WEATHER AND CLIMATE 9**

Weather and Climate - Causes of climate change - Milankovitch theory (change Natural cause) - Acid rain and human health impact - IPCC Assessment Report 4 - Climate parameter - temperature - atmospheric pressure - Milankovitch theory and climate - Sea surface temperature increases and aquatic organisms impact - IPC-Assessment Report 5 - Concept of sustainable development.

  
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Atmospheric humidity and rainfall - Human induced climate change (anthropogenic causes) - Weather and climate parameters measuring instruments - UNEP - United Nations Environment Programme - Concept of Carbon sequestration - Wind circulation - Global radiance balance of climate system – thermometer - hygrometer or psychrometer WMO - World Meteorological Organization - Terrestrial sequestration.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Successful completion of this course, the students will be able to:**

- Explain the importance of earth system and climate change adaptations mitigations
- Summarize climate parameters and their impact due to human activities.
- Demonstrate the impact of climate change in various sectors.
- Organize different protocol related to climate change with its causes and impact.
- Analyze projects related to atmospheric humidity and rainfall.

**TEXT BOOKS:**

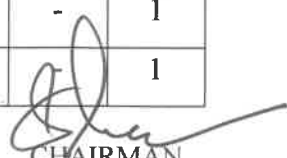
1. Dr. Zeena Flavia D Souza, Dr. Arpan Ray, Dr. Sayantan Dutta and Dr. Komala H.K., “Global Warming-Climate Change”, Kiwi International Publishing House, Madurai, 2025.
2. Dr. Md. Shahnawaz, “Global Warming and Climate Change Problem Policies and Politics”, Generic Publishing, 2017.

**REFERENCES:**

1. Wallace J.M and Hobbs P.V, “Atmospheric Science”, Elsevier, Academic Press,2006.
2. Bates B.C, Kundzewicz Z.W, Wu S and Palutikof J.P, “Climate Change and Water Technical Paper of the Intergovernmental Panel on Climate Change”, IPCC Secretariat, 2008.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	2	-	-	-	-	1
CO2	2	-	-	-	-	2	-	-	-	-	1
CO3	2	-	-	-	-	3	2	-	-	-	1
CO4	2	-	-	-	-	3	3	-	-	-	1
CO5	2	-	-	-	2	2	2	-	-	-	1

  
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24CE2020E

**BUILDING SERVICES**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand comfortable and safe construction with the services designed and installed.
- Infer knowledge on basis of electrical wiring system and telecommunication.
- Summarize importance of principles of illumination in buildings.
- Develop awareness on various principles of refrigerant and heat recovery devices.
- Organize fire safety installation and electric alarm circuits.

**UNIT I MACHINERIES 9**

Introduction of lifts and Escalators – Special features required for lifting arrangement and installation – Travelators – Controls – Machine room and equipments.

**UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 9**

Basics of electricity distribution – Earthing systems and bonding – Electrical wiring – Industrial installations – Lighting controls – Light sources, Lamps, Lighting design – Telecommunication installations.

**UNIT III PRINCIPLES OF ILLUMINATION 9**

Ventilation requirements – Mechanical ventilation – Fans and types – Boilers and types – Water treatments – Solar heating of water – Hot water storage cylinders.

**UNIT IV REFRIGERATION PRINCIPLES 9**

Heat emitters – Expansion facilities of heating system – Energy management system – Factors affecting fuels – Oil sand properties of natural gas – Air conditioning, principles and applications – Refrigerant and system characteristics – Heat recovery devices.



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Fire prevention and control systems – Fire alarms – Electrical alarm circuits – Smoke extraction and ventilation – Gas extinguishers – Types of detectors – Gas installation and components.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to:**

- Explain the special features in installation of lifts and escalators.
- Demonstrate electricity distribution earthing systems and bonding in buildings.
- Outline requirements of ventilation and principles of illumination.
- Utilize air conditioning and energy management system in buildings.
- Analyze need for fire detection and protection in working environment.

**TEXT BOOKS:**

1. Roger Greeno and Fred Hall, “Building Services Handbook”, Elsevier Publishers 4<sup>th</sup> Edition, 2007.
2. Rao S and P Saluja H L, “Electrical Safety, Fire Safety Engineering and Safety Management”, Khanna Publishers, 1st Edition, 2016.

**REFERENCES:**

1. Steffy G, “Architectural Lighting Design”, John Wiley and Sons, 3<sup>rd</sup> Edition, 2008.
2. Killinger J and Killinger L, “Heating and Cooling Essentials”, Goodheart Wilcox Publishers, 2003.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	2	2	2	-	-	-	1
CO2	2	-	-	-	2	2	3	-	-	-	1
CO3	2	-	-	-	2	3	3	-	-	-	1
CO4	2	-	-	-	2	3	3	-	-	-	
CO5	2	-	-	-	2	2	2	-	-	-	

  
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24CS2010E

**FUNDAMENTALS OF OPERATING SYSTEMS**

**L T P C**

**(Common to AGE, CIVIL, BME, ECE, EEE &  
MECH)**

**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Illustrate the fundamental concepts and functions of operating systems.
- Discuss the management of processes and threads.
- Examine process synchronization, inter-process communication, and deadlock situations.
- Implement memory management strategies, including virtual memory.
- Assess file systems, disk scheduling, and I/O management techniques.

**UNIT I INTRODUCTION**

**9**

Introduction to Operating Systems - Operating System Operations - Resource Management - Operating System Services - Virtualization - User and Operating System Interface - System Calls - Operating System Structures - Building and Booting an Operating System.

**UNIT II PROCESSES AND THREADS**

**9**

Process Concept - Process Scheduling - Operations on Processes - Interprocess Communication - IPC in Shared - Memory Systems - IPC in Message - Passing Systems - Examples of IPC Systems - Threads - Overview - Multithreading models - Pthreads

**UNIT III PROCESS MANAGEMENT AND SYNCHRONIZATION**

**9**

Basic Concepts of CPU Scheduling - Scheduling Criteria - Scheduling Algorithms - The Critical - Section Problem - Peterson's Solution - Synchronization Hardware - Mutex Locks - Semaphores - Classic Problems of Synchronization - Monitors - Deadlocks - Prevention - Avoidance - Detection - Recovery

**UNIT IV MEMORY MANAGEMENT**

**9**

Contiguous Memory Allocation - Paging - Structure of the Page Table - Segmentation - Swapping - Example Architectures - Demand Paging - Page Replacement - Allocation of Frames - Thrashing

**UNIT V STORAGE MANAGEMENT**

**9**

File Concept - Access Methods - Directory Structure - Protection - Directory Implementation - Allocation Methods - Free - Space Management - Mass - Storage Structure - HDD Scheduling

**TOTAL: 45 PERIODS**

  
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BoS (CSE)

**OUTCOMES:**

Upon completion of the course, the students will be able to

- Understand the structure, services, and basic functionalities of operating systems.
- Analyze process and thread creation, management, and inter-process communication.
- Design scheduling algorithms and apply synchronization and deadlock handling techniques.
- Evaluate and compare memory management schemes like paging and segmentation.
- Analyze file systems, disk scheduling, and I/O management in storage systems.

**TEXT BOOKS:**

1. Abraham Silberschatz, Greg Gagne and Peter B. Galvin. “Operating System Concepts”, 10<sup>th</sup> Edition, John Wiley & Sons Inc., 2018.

**REFERENCES:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2012.
2. D. M. Dhamdhare. “Operating Systems: A Concept– Based Approach”, 3<sup>rd</sup> Edition, Tata McGrawHill, 2017.
3. William Stallings. “Operating Systems: Internals and Design Principles”, 9<sup>th</sup> Edition, Pearson, 2017.
4. Andrew S. Tanenbaum, Herbert Bos. “Modern Operating Systems”, 5<sup>th</sup> Edition, Pearson, 2023.
5. Douglas Comer, “Operating System Design: The XINU Approach”, 2<sup>nd</sup> Edition, CRC Press, 2023.

**COs - POs Mapping**

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	1	3	2	2	3	1	2	-	2	3
2	3	3	3	2	2	2	1	2	-	2	3
3	3	3	3	2	2	2	1	2	-	2	3
4	3	3	3	2	1	2	1	2	-	2	3
5	3	3	3	2	1	2	1	2	-	2	3

  
 CHAIRMAN  
 BoS (CSE)

24CS202OE

**INTRODUCTION TO DATABASE**  
(Common to AGE, CIVIL, BME, ECE, EEE &  
MECH)

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Describe the fundamentals of database systems and conceptual data modeling.
- Use the principles of the relational model to construct SQL queries.
- Develop database applications and design relational schemas.
- Examine transaction processing, concurrency control, and recovery mechanisms.
- Assess the role of Distributed Databases and NoSQL systems in modern applications.

**UNIT I INTRODUCTION TO DATABASE SYSTEMS 9**

Introduction to Databases - File System Vs Database System - Data Models - Schemas and Instances - DBMS Architecture - Centralized - Client Server - Database Applications - ER Models - ER to Relational Mapping

**UNIT II RELATIONAL MODELS 9**

Relational Model - Constraints - Keys - Dependencies - Relational Algebra - Unary, Binary, Set and Extended Relational Algebra operations - SQL - Data Definition - Data Manipulation and Retrieval Queries - Nested Queries - Joins - Views - Cursors - Procedures - Functions - Triggers - Embedded and Dynamic SQL

**UNIT III RELATIONAL DATABASE DESIGN 9**

Database Design - Functional Dependencies - Normalization - 1 NF - 2 NF - 3 NF - BCNF - Multivalued Dependency (4 NF) - Join Dependency (PJNF)

**UNIT IV TRANSACTIONS AND RECOVERY 9**

Transaction processing concepts - Need for concurrency control and recovery - ACID Properties - Recoverability - Serializability - Concurrency Control - Two phase locking Techniques - Timestamp based protocol - Graph based protocol - Deadlock handling - Log based recovery - Two Phase Commit Protocol

**UNIT V QUERY PROCESSING AND ADVANCED DATABASES 9**

Indexing and Hashing Techniques - Query Processing and Optimization - Sorting and Joins - Database Tuning - Introduction to Spatial and Temporal Databases - OO Databases - NoSQL.

**TOTAL: 45 PERIODS**

  
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BoS (CSE)

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the basic database concepts and construct ER models for simple applications.
- Formulate SQL queries to manage and retrieve data from relational databases.
- Apply programming and design techniques to enhance database structure through normalization.
- Implement transactions using concurrency control and recovery methods.
- Analyze and evaluate Distributed and NoSQL databases for varied application needs.

## TEXT BOOKS:

1. Jagdish Chandra Patni, Hitesh Kumar Sharma, Ravi Tomar, Avita Katal, "Database Management System An Evolutionary Approach", 2022.

## REFERENCES:

1. Narain Gehani and Melliya Annamalai, "The Database Book: Principles and Practice Using the Oracle Database System", Universities Press, 2012.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson/Addison, Wesley, 2016.
4. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2019.
5. Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management", First Edition 2019.

## COs - POs Mapping

COURSE OUTCOMES	PO										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	3	3	3	2	-	2	-	1	3
2	3	3	3	3	3	2	-	2	-	1	2
3	3	3	3	3	2	2	-	3	-	1	3
4	3	3	3	3	3	2	-	1	-	1	2
5	3	3	3	2	3	2	-	2	-	1	3

  
CHAIRMAN  
BoS (CSE)

**OBJECTIVES:****The Students Should be made to**

- Introduce the concept and evolution of virtual instrumentation and its advantages over conventional systems.
- Familiarize students with the architecture, programming techniques, and data-flow concepts used in graphical programming environments.
- Enable students to understand various interfacing standards and data acquisition techniques for instrumentation systems.
- Develop skills to design and implement virtual instruments for real-time and embedded applications.
- Expose students to the available toolsets for signal processing, image processing, motion control, and control design.

**UNIT I INTRODUCTION****9**

Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

**UNIT II PROGRAMMING TECHNIQUES****9**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, mathscript.

**UNIT III INTERFACE REQUIREMENTS****9**

Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI, VISA and IVI, Data Acquisition Hardware.

**UNIT IV APPLICATION OF VIRTUAL INSTRUMENTATION****9**

Application of Virtual Instrumentation: Instrument Control using RS-232C and IEEE488, Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming, Publishing measurement data in the web.

**UNIT V TOOLSETS****9**

Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control.

**TOTAL:45 PERIODS**

  
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BoS (ECE) 28/10/25

**OUTCOMES:**

On successful completion of this course, the students will be able to

- Explain the architecture and fundamental concepts of virtual instrumentation systems..
- Develop and debug virtual instruments using graphical programming techniques.
- Interface virtual instruments with hardware using standard communication and bus interfaces.
- Design real-time and embedded virtual instruments for industrial and research applications.
- Utilize advanced toolsets for control design, DSP, image processing, and motion control applications.

**TEXT BOOK:**

1. Gary Johnson. "LabVIEW Graphical Programming" 2<sup>nd</sup> edition, McGraw Hill, New York, 1997.
2. Lisa K. wells & Jeffrey Travis, "LabVIEW for everyone", Prentice Hall, New Jersey, 1997.

**REFERENCES:**

1. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.
2. Rick Bitter, "LabVIEW Advanced Programming Technique", 2<sup>nd</sup> Edition, CRC Press, 2005
3. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1<sup>st</sup> Edition, PHI, 2001.

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	-	-	-	-	-	1	2
CO2	2	3	3	2	2	-	-	-	-	2	3
CO3	2	2	3	2	3	-	-	-	-	2	3
CO4	2	3	3	2	3	-	1	-	-	2	3
CO5	2	2	3	2	3	-	1	-	-	2	3

  
CHAIRMAN  
BoS (ECE)

**OBJECTIVES:****The Students Should be made to**

- Introduce the basic structure and functioning of telecommunication systems and networks.
- Provide an understanding of various types of connectivity, numbering, routing, and switching used in telecommunications.
- Explain the concept of Quality of Service (QoS) for voice, data, and image transmission and the factors affecting it.
- Describe the transmission aspects of voice telephony and video communication systems.
- Familiarize students with television and CATV systems, their evolution, transmission standards, and digital implementation.

**UNIT I INTRODUCTORY TO TELECOMMUNICATIONS 9**

End-Users, Nodes, and Connectivities, Telephone Numbering and Routing, Use of Tandem Switches in a Local Area Connectivity, Introduction to the Busy Hour and Grade of Service, Simplex, Half-Duplex, and Full Duplex, One-Way and Two-Way Circuits, Network Topologies, Variations in Traffic Flow, Quality Of Service, Standardization in Telecommunications, The Organization of the PSTN in the United States, Points of Presence.

**UNIT II QUALITY OF SERVICE 9**

Objective, Quality of Service: Voice, Data, and Image, Signal-to-Noise Ratio, Voice Transmission, Data Circuits, Video (Television), The Three Basic Impairments and How They Affect the End-User, Amplitude Distortion, Phase Distortion, Noise Level, Typical Levels, Echo and Singing.

**UNIT III TRANSMISSION ASPECTS OF VOICE TELEPHONY 9**

Definition of the Voice Channel, Operation of the Telephone Subset, Subscriber Loop Design, Design of Local Area Wire-Pair Trunks (Junctions), VF Repeaters (Amplifiers).

**UNIT IV TELEVISION TRANSMISSION 9**

Background and Objectives, An Appreciation of Video Transmission, Critical Video Parameters, Video Transmission Standards (Criteria for Broadcasters), Methods of Program Channel Transmission, The Transmission of Video Over LOS Microwave, TV Transmission by Satellite Relay, Digital Television, Conference Television, Brief Overview of Frame Transport for Video Conferencing.

**UNIT V COMMUNITY ANTENNA TELEVISION 9**

Objective and Scope, The Evolution of CATV, System Impairments and Performance Measures, Hybrid Fiber-Coax (HFC) Systems, Digital Transmission of CATV Signals, Two-Way CATV Systems, Two-Way Voice and Data over CATV Systems Based on the DOCSIS 2.0 Specification, Subsplit / Extended Subsplit Frequency Plan, Other General Information.

**TOTAL:45 PERIODS**

*M. Phane*  
CHAIRMAN  
BoS (ECE) 28/10/25

**OUTCOMES:**

On successful completion of this course, the students will be able to

- Explain the fundamental components and connectivity structures in telecommunication networks.
- Analyze the impact of Quality-of-Service parameters on voice, data, and image transmission.
- Illustrate the transmission aspects of voice telephony including subscriber loops, trunks, and repeaters.
- Describe the principles and standards used in television and video transmission systems.
- Evaluate the design and performance of CATV and digital cable transmission systems.

**TEXT BOOK:**

1. Roger L. Freeman, "Fundamentals of Telecommunications" 2<sup>nd</sup> Edition, John Wiley & Sons Publications 2005.
2. Annabel Z. Dodd, "The Essential Guide to Telecommunications", 5<sup>th</sup> Edition, Prentice Hall 2012.

**REFERENCES:**

1. Jyrki T. J. Penttinen, "The Telecommunications Handbook" John Wiley & Sons Publications 2015.
2. Prof. Dr. Muhammad EL-SABA, "Telecommunications systems and data networks", 3<sup>rd</sup> Edition 2015.

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	-	-	-	-	1	-
CO2	2	3	2	3	3	-	1	-	-	2	1
CO3	3	3	3	2	3	-	-	-	-	2	1
CO4	2	2	3	2	3	-	-	-	-	2	2
CO5	2	3	3	3	3	-	1	-	-	2	2

  
 CHAIRMAN  
 BoS (ECE)

24ME2010E

BASICS OF AUTOMOTIVE COMPONENTS

L T P C

3 0 0 3

**OBJECTIVES:**

**The student should be made to:**

- Provide knowledge on various engine components of automobiles.
- Explain the working principles of flywheel, Clutch, and Transmission systems
- Understanding the vehicle construction, body layouts and aerodynamics.
- Familiarize with steering, suspension, and braking systems, including modern technologies like ABS and power steering
- Know the concepts of hybrid vehicle technologies, their components, working, and comparative advantages over conventional vehicles

**UNIT I ENGINE COMPONENTS 9**

Overview – Engine Components – Engine block, Crank shaft, Connecting rod, Cylinder Liners, Piston, Piston rings, Cylinder head – Camshaft, Valve, Rocker Arm, Spark Plug, Injector, Carburetor, Fuel pump.

**UNIT II TRANSMISSION COMPONENTS 9**

Flywheel – Clutch – Friction plate, Clutch housing, Pressure plate. Gearbox – Propeller shaft – Differential – Conventional Differential, Rear axle.

**UNIT III BODY COMPONENTS 9**

Types of automobiles – Vehicle construction and different layouts, chassis, Frame and body – Vehicle aerodynamics.

**UNIT IV STEERING, SUSPENSION SYSTEMS AND BRAKES 9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS).

**UNIT V IGNITION SYSTEMS AND HYBRID VEHICLE 9**

Ignition System – Battery and Magneto Ignition System – Principles of Combustion and detonation CI Engines. Lubrication and Cooling systems. Hybrid Vehicles: Components of hybrid vehicles - layout & working principle of hybrid vehicles - comparison with electric vehicles - advantages and disadvantages of hybrid vehicles.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
(BoS / MECH) 28/10/25

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Describe the construction, function, and operation of major engine components.
- Explain the working and application of transmission components such as clutch, gearbox, propeller shaft, and differential.
- Compare different automobile layouts, chassis designs, and evaluate their impact on vehicle aerodynamics
- Summarize the design and performance of steering systems, suspension arrangements, and braking mechanisms, including modern safety systems
- Develop the suitability of ignition systems, and explain the principles of hybrid vehicle.

**TEXT BOOKS:**

1. Kirpal Singh, “Automobile Engineering”, Vol. 1 and 2, Seventh Edition, Standard Publishers, New Delhi, 14th Edition 2017.
2. Ganesan V, “Internal Combustion Engines”, Tata McGraw-Hill, 4th Edition, 2018.

**REFERENCES:**

1. Joseph Heitner, “Automotive Mechanics,” East-West Press, Second Edition, 1999.
2. Jain K K and Asthana R B, “Automobile Engineering”, Tata McGraw Hill Publishers, New Delhi, 2002.
3. Martin W, Stockel and Martin T Stockle, “Automotive Mechanics Fundamentals”, The Good Heart-Will Cox Company Inc, USA, 1978.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	-	-	1
CO2	2	2	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	2	-	-	-	-	-	-	-	-	1
CO5	3	2	-	-	-	-	-	-	-	-	1

  
CHAIRMAN  
(BoS / MECH)

**OBJECTIVES:****The student should be made to:**

- Understand the principles and applications of mechanical energy-based unconventional machining processes.
- Explain the working mechanisms of thermal and electrical energy-based machining processes.
- Familiarize with machining of chemical and electrochemical-based processes.
- Examine the capabilities and limitations of advanced nano-finishing processes.
- Outline the scope and trends of advanced non-traditional machining processes.

**UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9**

Unconventional machining Process – Need – classification - merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles–equipment used – Process parameters–MRR – Applications.

**UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9**

Electric Discharge Machining (EDM) – Wirecut EDM - Working Principle – equipments – Process Parameters – Surface Finish and MRR - electrode /Tool - Power and control Circuits – Tool Wear – Dielectric – Flushing - Applications. Laser Beam machining and drilling (LBM) – plasma, Arc machining (PAM) and Electron Beam Machining (EBM) – Principles – Equipment - Types – Beam control techniques – Applications.

**UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9**

Chemical machining and Electro – Chemical machining (CHM and ECM) – Etchants – Maskant – techniques of applying maskants – Process Parameters – Surface finish and MRR – Applications. Principles of ECM – equipment's –Surface Roughness and MRR Electrical circuit–Process Parameters – ECG and ECH– Applications.

**UNIT IV ADVANCED NANOFINISHING PROCESSES 9**

Abrasive flow machining – chemo -mechanical polishing – magnetic abrasive finishing, magneto Rheological finishing – magneto rheological abrasive flow finishing - their working principles, equipments - effect of process parameters – applications - advantages and limitations.

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(BoS / MECH) 28/10/25

## UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes - their working principles - equipments, effect of process parameters – applications - advantages and limitations – Comparison of non-traditional machining processes.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Recognize the need for unconventional machining processes and their classification.
- Contrast various thermal energy and electrical energy based unconventional machining processes.
- Explain various chemical and electrochemical energy-based unconventional machining processes.
- Discuss various nano-abrasive-based unconventional machining processes.
- Differentiate various recent trends in unconventional machining processes.

### TEXT BOOKS:

1. Vijay K Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. Pandey P C and Shan H S, “Modern Machining Processes”, Tata McGraw Hill, New Delhi, 2011.

### REFERENCES:

1. Benedict GF, “Non traditional Manufacturing Processes”, Taylor and Francis Limited, 2019
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1988.
3. Ernest Paul De Garmo, Black J T and Ronald A Kohser, “Material and Processing Manufacturing”, John Wiley and Sons, Inc., 13<sup>th</sup> Edition, 2020.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	-	-	-	-	-	1
CO2	2	2	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	-	-	-	-	-	-	-	-	1
CO5	3	2	-	-	-	-	-	-	-	-	1

CHAIRMAN  
(BoS / MECH)

28/10/20

**OBJECTIVES:**

**The Student should be made to:**

- Learn the fundamentals of Internet, World Wide Web, protocols, browsers, and web servers.
- Understand design structured, interactive, and user-centric web pages using HTML, CSS, and JavaScript.
- Explore skills to manipulate the DOM and implement client-side scripting for dynamic web content.
- Familiarize with XML, PHP, and integration of PHP with databases using MySQL.
- Acquire knowledge to plan, implement, and publish complete web applications.

**UNIT I WEB BASICS AND DESIGN 9**

Introduction: Concept of WWW - Internet Vs. WWW - HTTP Protocol - Request and Response - Web Browsers and Web Servers - Features of Latest Version of Web. Web Design: Concepts of Effective Web Design - Browser Compatibility - Bandwidth - Cache - Display Resolution: Look and Feel of the Website - Page Layout - and Linking - User-centric Design: Sitemap - Planning and Publishing a Website.

**UNIT II HTML AND CSS 9**

HTML: Basics of HTML - Text Formatting - Fonts - Commenting Code - Colors - Hyperlinks - Lists - Tables - Images - Forms - XHTML - Meta Tags - Character Entities - Frames and Frame sets - Browser Architecture and Website Structure - Overview of Latest HTML version Features. CSS: Need - Introduction - Syntax and Structure - Backgrounds - Colors - Text Styling - Fonts - Borders - Boxes - Margins -Padding - Lists.

**UNIT III JAVASCRIPT AND DHTML 9**

JavaScript: Client-side scripting - Variables - Functions - Conditional Statements - Loops and Repetition - Pop-up boxes and alerts - Advanced JavaScript: Objects - JavaScript's Built-in Objects - DOM - Web Browser Environments - DOM manipulation - Forms - Validations.

**UNIT IV XML AND PHP BASICS 9**

XML: Introduction - Uses - Simple XML - Key Components - DTD and Schema - XML with applications - Transforming XML using XSL and XSLT.



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BoS (IT)

PHP: Introduction and basic syntax - Decision-making and looping - PHP and HTML integration - Arrays and Functions - Browser control and detection - Strings, - Form Processing - File Handling - Advanced features: Cookies and Sessions.

**UNIT V PHP AND MYSQL**

**9**

PHP - MySQL integration: Basic commands - Connection to server - Creating Databases and Tables - Selecting Databases - Listing Databases and Table Names - Insertion - Update - Delete data and Tables - Handling Database Errors - Database Management - Case Study.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Able to explain web fundamentals, protocols, browsers, and server concepts.
- Design structured, interactive, and user-centric web pages using HTML and CSS.
- Implement dynamic client-side functionality using JavaScript and DHTML.
- Develop server-side scripts using PHP and integrate them with XML and MySQL databases.
- Implement and publish functional web applications using PHP-MySQL.

**TEXT BOOKS:**

1. HTML 5 Black Book - Web Technologies: HTML, XHTML, CSS, XML, JavaScript, AJAX, PHP and MySQL, 2<sup>nd</sup> Edition, Dreamtech Press, 2016.

**REFERENCES:**

1. Ivan Bayross, Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl, CGI, PHP, and MySQL, BPB Publications, 2020.
2. Achyut S. Godbole & Atul Kahate, Web Technologies: TCP/IP to Internet Application Architectures, McGraw Hill, 2018.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	-	1	-	-	-	-	-	2
2	2	2	3	-	2	1	-	1	2	-	2
3	2	2	3	-	3	-	-	1	2	-	2
4	3	3	3	2	3	1	-	1	2	1	3
5	3	3	3	2	3	1	1	2	3	2	3

  
 CHAIRMAN  
 BoS (IT)

28/10/25

24IT202OE

PRINCIPLES OF MULTIMEDIA

L T P C  
3 0 0 3

**OBJECTIVES:**

**The Student should be made to:**

- Provide an understanding of multimedia systems, applications, and underlying principles.
- Introduce various multimedia data types such as text, audio, image, video, and animation.
- Explain data compression techniques for efficient storage and transmission.
- Familiarize students with multimedia authoring tools, software, and design principles.
- Explore applications of multimedia in communication, education, entertainment, and the web.

**UNIT I INTRODUCTION TO MULTIMEDIA 9**

Multimedia: Introduction - Definitions - Components - Text - Audio - Video - Graphics and Animation - Multimedia Applications: Education, Entertainment - Training - Kiosks and Presentations - Multimedia System Architecture - Multimedia Hardware: Input/Output Devices - Storage Devices - Multimedia Software: Authoring Tools - Presentation Tools - Virtual Reality and Multimedia.

**UNIT II TEXT, AUDIO AND IMAGE 9**

Text: Types of Text - Unicode Standards - Text Compression Techniques - Audio: Acoustics - Digital Representation of Sound - Waveform and MIDI Audio - Audio Compression Techniques - Audio Standards - Image: Digital Image Representation - Color Models - Sampling and Quantization - Image Formats - Image Compression Standards.

**UNIT III VIDEO AND ANIMATION 9**

Video: Analog and Digital Video - Video Formats - Characteristics of Video Signals – Digitization - Video Compression Standards - Animation: Types of Animation - Principles of Animation - Animation Techniques - Morphing - Motion Capture - Animation Software Tools.

**UNIT IV MULTIMEDIA DATA COMPRESSION 9**

Need for compression - Lossless Compression Techniques: Run Length Encoding - Huffman Coding - Arithmetic Coding - Dictionary Based Compression - Lossy Compression Techniques: Transform coding - JPEG, MPEG Compression - Comparison of Compression Techniques and their Applications in Multimedia Systems.

  
CHAIRMAN  
BoS (IT)

**UNIT V MULTIMEDIA TOOLS AND APPLICATIONS**

9

Multimedia Authoring Tools: Authoring Metaphors - Card-Based - Timeline-Based - Icon-Based and Object-Oriented Authoring - Multimedia Databases - Multimedia Applications in Education - Business - Entertainment and the Web - Designing Multimedia Applications - Multimedia and the Internet - Future Trends in Multimedia Technology.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Describe the fundamentals, architecture, and applications of multimedia systems.
- Understand representation, storage, and processing of text, audio, and images.
- Explain video and animation concepts with related standards and techniques.
- Apply compression algorithms for efficient multimedia storage and transmission.
- Use authoring tools to design simple multimedia applications for real-world domains.

**TEXT BOOKS:**

1. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Springer, 2<sup>nd</sup> Edition, 2021.

**REFERENCES:**

1. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, Pearson Education, 2019.
2. Tay Vaughan, Multimedia: Making It Work, 9<sup>th</sup> Edition, McGraw Hill, 2018.
3. Prabhat K. Andleigh and Kiran Thakrar, Multimedia Systems Design, PHI, 2020.
4. Fred T. Hofstetter, Multimedia: Basics, Technology, and Future, Pearson, 2019.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	-	1	1	-	-	-	-	2
2	3	2	2	1	2	-	-	-	-	-	2
3	2	2	3	-	2	1	-	-	-	-	2
4	3	3	2	2	3	-	-	-	-	-	2
5	2	2	3	1	3	1	1	2	2	2	3

  
 CHAIRMAN  
 BoS (IT)

28/10/25

24M101

**FINANCIAL MANAGEMENT**  
**(Common to all Branches)**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the knowledge of the decision areas in finance.
- Learn the various sources of Finance.
- Study about capital budgeting and cost of capital.
- Learn on how to construct a robust capital structure and dividend policy.
- Study about the tools on Working Capital Management.

**UNIT I INTRODUCTION TO FINANCIAL MANGEMENT 9**

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization - Time Value of money - Risk and Return Concepts.

**UNIT II SOURCES OF FINANCE 9**

Long Term Sources of Finance - Equity Shares - Debentures - Preferred Stock - Features - Merits and Demerits - Short Term Sources - Bank Sources - Trade Credit – Overdrafts - Commercial Papers - Certificate of Deposits - Money Market Mutual Funds.

**UNIT III INVESTMENT DECISIONS 9**

Investment Decisions: Capital Budgeting - Need and Importance - Techniques of Capital Budgeting - Payback - ARR - NPV - IRR - Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity - Preferred Stock - Debt - Reserves - Concept and Measurement of Cost of Capital - Weighted Average Cost of Capital.


**UNIT IV FINANCING AND DIVIDEND DECISION 9**

Operating Leverage and Financial Leverage - EBIT - EPS Analysis. Capital Structure - Determinants of Capital Structure - Designing an Optimum Capital Structure. Dividend Policy - Aspects of Dividend Policy - Practical Consideration - Forms of Dividend Policy - Determinants of Dividend Policy.

**UNIT V WORKING CAPITAL DECISION 9**

Working Capital Management: Working Capital Management - Concepts - Importance - Determinants of Working Capital - Cash Management: Motives for Holding Cash - Objectives and Strategies of Cash Management - Receivables Management: Objectives - Credit Policies.

**TOTAL: 45 PERIODS**

  
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**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain about the decision areas in finance.
- Discuss about the various sources of Finance.
- Work on capital budgeting and cost of capital.
- Construct a robust capital structure and dividend policy.
- Handle the tools on Working Capital Management.

**TEXT BOOKS:**

1. M.Y. Khan and P.K.Jain, Financial management, Text, Tata McGraw Hill, Ltd.
2. M. Pandey, Financial Management, Vikas Publishing House Pvt. Ltd.

**REFERENCES:**

1. James C. Vanhorne, Fundamentals of Financial Management, PHI Learning.
2. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	2	1	-	-	-	1	-	-	3	3	2
2	2	1	-	-	-	1	2	-	3	3	2
3	2	1	-	-	-	1	-	--	3	3	2
4	2	1	-	-	-	1	2	-	3	3	2
5	2	1	-	-	-	1	-	-	3	3	2

  
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 BoS (IT)

28/10/24

24M102

**FUNDAMENTALS OF INVESTMENT**  
**(Common to all Branches)**

L T P C  
3 0 0 3

**OBJECTIVES:**

**The Student should be made to:**

- Study about the investment environment in which investment decisions are taken.
- Acquire knowledge on how to Value bonds and equities.
- Learn the various approaches to value securities.
- Study on how to create efficient portfolios through diversification.
- Learn the mechanism of investor protection in India.

**UNIT I THE INVESTMENT ENVIRONMENT 9**

Investment Decision Process - Types of Investments - Commodities - Real Estate and Financial Assets - Indian Securities Market - Market Participants and Trading of Securities - Security Market Indices - Sources of Financial Information - Concept of Return and Risk - Impact of Taxes and Inflation on Return.

**UNIT II FIXED INCOME SECURITIES 9**

Bond Features - Types of Bonds - Estimating Bond Yields - Bond Valuation Types of Bond Risks - Default Risk and Credit Rating.

**UNIT III APPROACHES TO EQUITY ANALYSIS 9**

Introduction to Fundamental Analysis - Technical Analysis and Efficient Market Hypothesis - Dividend Capitalization Models - Price-Earnings Multiple Approach to Equity Valuation.

**UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9**

Portfolio and Diversification - Portfolio Risk and Return - Mutual Funds - Introduction to Financial Derivatives - Financial Derivatives Markets in India.

**UNIT V INVESTOR PROTECTION 9**

Investor Grievances and their Redressal System - Insider Trading - Investors' Awareness and Activism.

**TOTAL: 45 PERIODS**

  
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**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Describe the investment environment in which investment decisions are taken.
- Explain how to Value bonds and equities.
- Explain the various approaches to value securities.
- Create efficient portfolios through diversification.
- Discuss the mechanism of investor protection in India.

**TEXT BOOKS:**

1. Charles P. Jones - Gerald R. Jensen, Investments: analysis and management. Wiley - 14<sup>th</sup> Edition - 2019.

**REFERENCES:**

1. Chandra, Prasanna, Investment analysis and portfolio management. McGraw-hill education, 5<sup>th</sup> Edition, 2017.
2. Rustagi R. P, Investment Management Theory and Practice. Sultan Chand & Sons - 2021.
3. ZviBodie, Alex Kane, Alan J Marcus , PitabusMohanty, Investments - McGraw Hill Education (India), 11<sup>th</sup> Edition, 2019.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	-	-	2	-	-	-	-	-	1
2	3	3	-	2	2	-	-	-	-	-	-
3	3	3	2	-	2	-	-	-	-	-	-
4	3	-	-	2	2	-	-	-	-	-	1
5	-	-	-	-	-	2	-	3	-	-	1

  
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 BoS (IT)

28/10/20

24M103

**BANKING, FINANCIAL SERVICES AND INSURANCE**

**L T P C**

**(Common to all Branches)**

**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Study about the Banking system in India.
- Understand knowledge on how banks raise their sources and how they deploy it.
- Learn the development in banking technology.
- Study about the financial services in India.
- Acquire knowledge about the insurance Industry in India.

**UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM 9**

Overview of Banking System - Structure - Functions - Banking System in India - Key Regulations in Indian Banking Sector - RBI - Relationship between Banker and Customer - Retail and Wholesale Banking - Types of Accounts - Opening and Operation of Accounts.

**UNIT II MANAGING BANK FUNDS / PRODUCTS 9**

Liquid Assets - Investment in Securities - Advances - Loans - Negotiable Instruments - Cheques - Bills of Exchange - Promissory Notes - Designing Deposit Schemes - Liability Management - NPA's - Current Issues on NPA's - M &A's of Banks into Securities Market.

**UNIT III DEVELOPMENT IN BANKING TECHNOLOGY 9**

Payment System in India - Paper Based - E-Payment - Electronic Banking - Plastic Money - E-Money - Forecasting of Cash Demand at ATM's - Information Technology Act, 2000 in India - RBI's Financial Sector Technology Vision Document - Security Threats in E-Banking - RBI's Initiative.

**UNIT IV FINANCIAL SERVICES 9**

Introduction - Need for Financial Services - Financial Services Market in India - NBFC - Leasing and Hire Purchase - Mutual Funds - Venture Capital Financing - Bill Discounting - Factoring - Merchant Banking.

**UNIT V INSURANCE 9**

Insurance - Concept - Need - History of Insurance Industry in India - Insurance Act, 1938 - IRDA - Regulations - Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy - Revival - Settlement of Claim.

**TOTAL: 45 PERIODS**

  
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BoS (IT)

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand the Banking system in India.
- Discuss how banks raise their sources and how they deploy it.
- Explain the development in banking technology.
- Discuss about the financial services in India.
- Explain the insurance Industry in India.

**TEXT BOOKS:**

- Padmalatha Suresh and Justin Paul, Management of Banking and Financial Services, Pearson, Delhi, 2017.

**REFERENCES:**

1. Meera Sharma, Management of Financial Institutions - with emphasis on Bank and Risk Management, PHI Learning Pvt. Ltd., New Delhi, 2010.
2. Peter S. Rose and Sylvia C. and Hudgins, Bank Management and Financial Services, Tata McGraw Hill, New Delhi, 2017.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	1	-	-	2	-	-	-	1	-
2	2	3	-	-	-	-	-	-	-	3	-
3	3	3	2	-	-	-	-	-	-	-	-
4	2	3	2	3	-	-	-	-	-	-	3
5	3	2	-	-	3	2	-	-	-	-	-

  
CHAIRMAN  
BoS (IT)

28/10/22

<b>24M104</b>	<b>INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Common to all Branches)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The Student should be made to:**

- Study about the introduction of blockchain technology.
- Acquire knowledge on the usage of Cryptocurrency.
- Learn about the concept of Ethereum technology.
- Study about the Web3 and Hyperledger concepts .
- Acquire knowledge about the emerging trends related to blockchain technology.

**UNIT I INTRODUCTION TO BLOCKCHAIN 9**

Blockchain: Growth of Blockchain Technology - Distributed Systems - History of Blockchain and Bitcoin - Features of a Blockchain - Types - Consensus: Consensus Mechanism - Types - Consensus in Blockchain - Decentralization: Decentralization using Blockchain - Methods of Decentralization - Routes to Decentralization - Blockchain and Full Ecosystem Decentralization - Smart Contracts - Decentralized Organizations - Platforms for Decentralization.

**UNIT II INTRODUCTION TO CRYPTOCURRENCY 9**

Bitcoin - Digital Keys and Addresses - Transactions - Mining - Bitcoin Networks and Payments - Wallets - Alternative Coins - Theoretical Limitations - Bitcoin Limitations - Name Coin - Prime Coin - Zcash - Smart Contracts - Ricardian Contracts - Deploying Smart Contracts on a Blockchain.

**UNIT III ETHEREUM 9**

Introduction - Ethereum Network - Components of the Ethereum Ecosystem - Transactions and Messages - Ether Cryptocurrency / Tokens - Ethereum Virtual Machine - Ethereum Development Environment: Test Networks - Setting up a Private Net - Starting up the Private Network.

**UNIT IV WEB3 AND HYPERLEDGER 9**

Introduction to Web3 - Contract Deployment - POST Requests - Development Frameworks - Hyperledger as a Protocol - Reference Architecture - Hyperledger Fabric - Distributed Ledger - Corda.

  
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**UNIT V EMERGING TRENDS**

9

Kadena - Ripple - Rootstock - Quorum - Tendermint - Scalability - Privacy - Other Challenges - Blockchain Research - Notable Projects - Miscellaneous Tools.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain about the introduction of blockchain technology.
- Discuss about the usage of Cryptocurrency.
- Elaborate about the concept of Ethereum technology.
- Discuss about the Web3 and Hyperledger concepts.
- Discuss about the emerging trends related to blockchain technology.

**TEXT BOOKs:**

1. Imran. Bashi, Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained, Packet Publishing, 2<sup>nd</sup> Edition, 2018.

**REFERENCES:**

1. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2<sup>nd</sup> Edition, 2018
2. ArshdeepBahga, Vijay Madiseti, Blockchain Applications: A Hands On Approach, VPT, 2017.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	2	1	1	2	1	1	1	1	–	2
2	3	3	2	2	2	2	1	1	2	1	2
3	3	3	3	3	3	1	1	2	2	2	3
4	2	2	3	3	3	2	2	2	3	3	3
5	2	3	3	3	3	3	2	3	3	3	3



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BoS (IT)

28/10/25

24M105

**FINTECH PERSONAL FINANCE AND PAYMENTS**  
**(Common to all Branches)**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Study about the currency exchange and payment
- Acquire knowledge on the concept of digital finance and alternative finance.
- Learn about the concept of insurtech.
- Study about the process of peer to peer lending
- Acquire knowledge about the various regulatory issues related to finance.

**UNIT I CURRENCY EXCHANGE AND PAYMENT 9**

Understand the Concept of Crypto Currency - Bitcoin and Applications - Cryptocurrencies and Digital Crypto Wallets - Types of Cryptocurrencies - Applications - Block Chain - Artificial Intelligence - Machine Learning - Fintech Users - Individual Payments - RTGS Systems - Immediate Page 54 of 90 Payment Service (IMPS) - Unified Payments Interface - Legal and Regulatory Implications of Cryptocurrencies - Payment Systems and their Regulations - Digital Payments Smart Cards - Stored-Value Cards - EC Micropayments - Payment Gateways - Mobile Payments - Digital and Virtual Currencies - Security - Ethical - Legal - Privacy - Technology Issues.

**UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE 9**

History of Financial Innovation - Digitization of Financial Services - Crowd funding - Charity and Equity - Introduction to the Concept of Initial Coin Offering.

**UNIT III INSURETECH 9**

InsurTech Introduction - Business Model Disruption AI/ML in InsurTech - IoT and InsurTech - Risk Modeling - Fraud Detection Processing Claims - Underwriting Innovations in Insurance Services.

**UNIT IV PEER TO PEER LENDING 9**

P2P - Marketplace Lending - New Models - New Products in Market Place Lending P2P Infrastructure - Technologies - Concept of Crowdfunding - Architecture and Technology - Crowdfunding Unicorns and Business Models - SME/MSME Lending: Unique Opportunities and Challenges - Solutions and Innovations.

  
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**UNIT V REGULATORY ISSUES****9**

FinTech Regulations: Global Regulations - Domestic Regulations - Evolution of RegTech - RegTech Ecosystem: Financial Institutions - RegTech Ecosystem: Startups RegTech - Startups: Challenges - RegTech Ecosystem: Regulators - Use of AI in Regulation - Fraud Detection.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain about the currency exchange and payment.
- Discuss on the concept of digital finance and alternative finance.
- Elaborate about the concept of insurtech.
- Discuss about the process of peer to peer lending.
- Explain about the various regulatory issues related to finance.

**TEXT BOOKS:**

- Swanson Seth, Fintech for Beginners: Understanding and utilizing the power of technology, Createspace Independent Publishing Platform, 2016.

**REFERENCES:**

- Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019.
- Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016.
- Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016.
- IIBF, Digital Banking, Taxmann Publication, 2016.
- Jacob William, Financial Technology, Create space Independent Pub, 2016.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	2	2	3	2	1	2	1	2	1
2	3	3	3	2	2	2	2	2	1	2	1
3	3	3	3	3	3	2	2	2	2	2	1
4	3	3	3	3	3	3	2	2	2	2	1
5	3	3	2	3	2	3	3	3	2	2	2

  
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 BoS (IT)

28/10/25

24M106

**INTRODUCTION TO FINTECH**  
**(Common to all Branches)**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Learn about history, importance and evolution of Fintech.
- Acquire the knowledge of Fintech in payment industry.
- Acquire the knowledge of Fintech in insurance industry.
- Learn the Fintech developments around the world.
- Study about the future of Fintech.

**UNIT I INTRODUCTION TO FINTECH 9**

Fintech - Definition - History - Concept - Meaning - Architecture - Significance - Goals - Key Areas in Fintech - Importance of Fintech - Role of Fintech in Economic Development - Opportunities and Challenges in Fintech - Evolution of Fintech in Different Sectors of the Industry - Infrastructure - Banking Industry - Startups and Emerging Markets.

**UNIT II PAYMENT INDUSTRY 9**

Fintech in Payment Industry - Multichannel Digital Wallets - Applications Supporting Wallets - Onboarding and KYC Application - Fintech in Lending Industry - Formal Lending - Informal Lending - P2P Lending - POS Lending - Online Lending.

**UNIT III INSURANCE INDUSTRY 9**

Fintech in Wealth Management Industry - Financial Advice - Automated Investing - Socially Responsible Investing - Fractional Investing - Social Investing - Fintech in Insurance Industry - P2P Insurance - On-Demand Insurance - Consultation - Customer Engagement through Quote to Sell - Policy Servicing - Claims Management - Investment Linked Health Insurance.

**UNIT IV FINTECH AROUND THE GLOBE 9**

Fintech Developments - US - Europe - UK - Germany - Sweden - France - China - India - Regulatory and Policy Assessment for Growth of Fintech - Fintech as Disruptors - Financial Institutions Collaborating with Fintech Companies - New Financial World.

**UNIT V FUTURE OF FINTECH 9**

How Emerging Technologies Will Change Financial Services - Future of Financial Services - Banking on Innovation through Data - Why Fintech Banks will Rule the World - Fintech Supermarket - Banks Partnering with Fintech Start-Ups - Rise of Banktech - Fintech Impact on Retail Banking - Future without Money - Ethics in Fintech.

  
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**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain about history, importance and evolution of Fintech.
- Discuss about the process of Fintech in payment industry.
- Discuss about the process of Fintech in insurance industry.
- Handle the process of the various Fintech around the world.
- Discuss about the future of Fintech.

**TEXT BOOKs:**

- Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015

**REFERENCES:**

- Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016.
- Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016.
- Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018.
- Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020.

**COs – POs Mapping**

COURSE OUTCOMES	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	3	3	2	2	2	2	1	2	1	2	1
2	3	3	3	3	3	2	2	2	1	2	1
3	3	3	3	3	3	3	2	2	2	2	1
4	3	3	3	3	3	3	3	3	2	3	2
5	3	3	2	3	3	3	3	3	2	3	2

  
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BoS (IT)

**OBJECTIVES:****The student should be made to:**

- Understand the concepts, skills, traits, and factors influencing entrepreneurship.
- Integrate the concepts of business ownership, environmental factors, and functional areas of management for effective business decision-making.
- Study the concepts, principles, and characteristics of technopreneurship along with its societal, economic, and employment impacts.
- Explore technology-driven entrepreneurship, intrapreneurship, and global practices with focus on launching and managing tech-based ventures.
- Know effective business management strategies across diverse entrepreneurial forms and emerging trends at local, national, and global levels.

**UNIT I INTRODUCTION TO ENTREPRENEURSHIP 9**

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development

**UNIT II BUSINESS OWNERSHIP & ENVIRONMENT 9**

Types of Business Ownership – Business Environmental Factors – Political-Economic-Sociological-Technological-Environmental-Legal aspects – Human Resources. Mobilisation-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration.

**UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP 9**

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

**UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP 9**

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship - Success Stories of Technopreneurs - Case Studies.

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**UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP**

9

Effective Business Management Strategies for Franchising - Sub-Contracting - Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Learn the different types of entrepreneurs and assess the contribution of entrepreneurship to economic development.
- Choose business environments, management principles in HR, finance, marketing, and production systems for efficient administration.
- Solve the emerging trends in technopreneurship and its role in creating innovations, job opportunities, and economic growth.
- Apply entrepreneurial practices in technology ventures, and assess success stories and case studies of technopreneurs.
- Analyze franchising, subcontracting, leasing, and new entrepreneurial models and assess their impact on recent entrepreneurial developments.

**TEXT BOOKS:**

1. Khanka S S, “Entrepreneurial Development”, S.Chand & Co. Ltd., New Delhi, 2021.
2. Donal F Kuratko, “Entrepreneurship Theory, Process, Practice” Cengage Learning, 11<sup>th</sup> Edition, 2022.

**REFERENCES:**

1. Daniel Mankani, “Technopreneurship: The successful Entrepreneur in the new Economy”, Prentice Hall, 2003.
2. Edward Elgar, “Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe”, Wiley Publications, 2014.
3. Dennis Posadas, “JumpStart: A Technopreneurship Fable”, Pearson Prentice Hall, 2009.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	2	1	-	-	-	-	-	-	-	2	-
<b>CO2</b>	2	2	1	-	-	1	1	1	1	2	-
<b>CO3</b>	2	2	1	-	-	1	1	1	1	2	-
<b>CO4</b>	2	2	1	-	1	1	1	1	1	2	1
<b>CO5</b>	2	2	1	-	1	2	1	1	1	2	1

CHAIRMAN  
(BoS / MECH)

24M202

**TEAM BUILDING AND LEADERSHIP  
MANAGEMENT FOR BUSINESS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Describe the concepts of team dynamics, formation, and development.
- Integrate the leadership roles and strategies for building effective, high-performance teams.
- Interpret the attributes, traits, and power dimensions of effective leadership.
- Compare various leadership theories, models, and styles within organisational contexts.
- Know the behavioural aspects of leadership and challenges like conflict, negotiations

**UNIT I INTRODUCTION TO MANAGING TEAMS 9**

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams

**UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS 9**

Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

**UNIT III INTRODUCTION TO LEADERSHIP 9**

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

**UNIT IV LEADERSHIP IN ORGANISATIONS 9**

Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of Ethics and Values in Organisational Leadership.

**UNIT V LEADERSHIP EFFECTIVENESS 9**

Leadership Behaviour - Assessment of Leadership Behaviours - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

**TOTAL: 45 PERIODS**

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**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Differentiate the various types of teams and teamwork practices.
- Apply mentoring, coaching, and trust-building techniques in team development.
- Solve the interrelationship between leader, follower, and situational factors.
- Apply ethical and value-based approaches to leadership practice.
- Analyze the strategies for effective leadership in global and multicultural environments.

**TEXT BOOKS:**

1. Hughes R L, Ginnett R C, and Curphy G J, "Leadership: Enhancing the Lessons of Experience", McGraw Hill Education, India, 9<sup>th</sup> Edition, 2019.
2. Katzenback J R and Smith D K, "The Wisdom of Teams: Creating the High Performance Organizations", Harvard Business Review Press, 2015.

**REFERENCES:**

1. Haldar U K, "Leadership and Team Building", Oxford University Press, 2010.
2. Daft R L, "The Leadership Experience", Cengage, 2023.
3. Daniel Levi, "Group Dynamics for Teams", Sage Publications, 4<sup>th</sup> Edition, 2014.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	-	-	-	1	2	2	-
CO2	2	1	-	-	2	2	-	1	2	2	2
CO3	2	1	-	-	-	-	-	1	2	2	-
CO4	2	2	1	1	2	2	-	1	3	2	2
CO5	2	1	1	1	2	2	-	1	3	2	2

  
CHAIRMAN  
(BoS/ MECH)

24M203

**CREATIVITY AND INNOVATION  
IN ENTREPRENEURSHIP**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the concepts, forms, and qualities of creativity along with the role of environment and personality.
- Know the concepts of traits, training methods, and barriers associated with creative intelligence.
- Study levels, types, and sectoral characteristics of innovation.
- Learn the concepts of innovation and entrepreneurship
- Explore entrepreneurial mindset, motivation, and opportunity analysis.

**UNIT I CREATIVITY**

**9**

Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment-Creative Technology- - Creative Personality and Motivation.

**UNIT II CREATIVE INTELLIGENCE**

**9**

Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training- Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

**UNIT III INNOVATION**

**9**

Innovation: Definition- Levels of Innovation- Incremental vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators- Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity- Design Thinking and Innovation- Innovation as Collective Change-Innovation as a system.

**UNIT IV INNOVATION AND ENTREPRENEURSHIP**

**9**

Innovation and Entrepreneurship: Entrepreneurial Mindset, Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding - Entrepreneurial Opportunities- Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit.

  
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## UNIT V INNOVATIVE BUSINESS MODELS

9

Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Learn the differentiate between various forms of creativity and factors influencing creative performance.
- Apply creative tools, strategies, and techniques to overcome blocks to creativity.
- Solve theories of innovation and design thinking for practical application.
- Formulate the applications of innovation in building successful ventures
- Design responsible and sustainable business models for entrepreneurship.

### TEXT BOOKS:

1. Khanka S S., “Creativity and Innovation in Entrepreneurship”, Sultan Chand & Sons, 2021.
2. Pradip N Khandwalla, “Lifelong Creativity, An Unending Quest”, Tata Mc Graw Hill, 2004.

### REFERENCES:

1. Paul Trott, “Innovation Management and New Product Development”, 4<sup>th</sup> Edition, Pearson, 2018.
2. Vinnie Jauhari and Sudanshu Bhushan, “Innovation Management”, Oxford Higher Education, 2014.
3. Krishnamacharyulu C S G and Lalitha R, “Innovation Management”., Himalaya Publishing House, 2017.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	2	2	-	-	-	-	-
CO2	2	2	-	-	2	2	-	-	-	-	-
CO3	2	2	-	-	2	2	-	-	-	-	-
CO4	2	2	1	-	2	2	2	2	2	2	-
CO5	2	2	1	-	2	2		2	2	2	3

  
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**OBJECTIVES:****The student should be made to:**

- Realise the functions and orientations of marketing along with the traditional and modern marketing mix.
- Recognize the techniques of environmental scanning and the role of marketing research and information systems.
- Know the product life cycle strategies, product mix decisions, and branding practices.
- Investigate integrated marketing communication tools, personal selling process, and distribution channels.
- Learn modern practices like CRM, e-marketing, and services marketing in business contexts.

**UNIT I INTRODUCTION TO MARKETING MANAGEMENT 9**

Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.

**UNIT II MARKETING ENVIRONMENT 9**

Introduction - Environmental Scanning - Analysing the Organisation’s Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

**UNIT III PRODUCT AND PRICING MANAGEMENT 9**

Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.

**UNIT IV PROMOTION AND DISTRIBUTION MANAGEMENT 9**

Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics Management- Introduction to Retailing and Wholesaling.

  
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**UNIT V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT****9**

Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing - E-Marketing or Online Marketing.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Illustrate the application in developing an effective marketing strategy.
- Compare micro and macro environment factors affecting marketing decisions.
- Formulate suitable pricing strategies for national and global markets.
- Explain the effective promotion and distribution strategies for various market segments..
- Apply strategies for managing customer loyalty, buyer–seller relationships, and online marketing initiatives.

**TEXT BOOKS:**

1. Sherlekar S A, “Marketing Management”, Himalaya Publishing House, 2016.
2. Philip Kotler and Kevin Lane Keller, “Marketing Management”, 15<sup>th</sup> Edition, Pearson, 2015.

**REFERENCES:**

1. Vijay Prakash Anand, “Marketing Management: An Indian Perspective”, Biztantra, 2<sup>nd</sup> Edition, 2016.
2. Ramaswamy V S and Namakumari S, “Marketing Management: Global Perspective, Indian Context”, Macmillan Publishers India, 5<sup>th</sup> Edition, 2015.
3. Dr. Gupta C B and Dr. Rajan Nair N, “Marketing Management: Text and Cases”, 17<sup>th</sup> Edition, 2016.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	1	-	-	-	3	-	-
CO2	2	1	-	-	2	-	-	2	3	-	-
CO3	2	1	-	-	2	-	-	2	3	3	2
CO4	2	1	-	-	2	-	-	2	3	3	2
CO5	2	1	-	-	2	-	-	2	3	3	2



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**OBJECTIVES:****The student should be made to:**

- Describe the concepts, scope, and evolution of HRM along with the roles and challenges of HR managers.
- Understand the tools, methods, and recent trends in human resource planning and career management.
- Know the different sources, techniques, and processes of recruitment and selection in domestic and global contexts.
- Discover training types, compensation practices, and sustainable HR initiatives like Green HRM.
- Evaluate performance appraisal systems, grievance redressal methods, and employee relations practices.

**UNIT I INTRODUCTION TO HRM**

9

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

**UNIT II HUMAN RESOURCE PLANNING**

9

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

**UNIT III RECRUITMENT AND SELECTION**

9

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

**UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT**

9

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices.

**UNIT V CONTROLLING HUMAN RESOURCES**

9

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends.

**TOTAL: 45 PERIODS**

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**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand the Evolution of HRM and Challenges faced by HR Managers
- Apply HRIS and computer-based approaches in HR planning.
- Interpret employee engagement practices in relation to recruitment and selection.
- Apply effective training and development programs to enhance employee performance.
- Formulate HR strategies for conflict resolution, promotion, and union–management relations.

**TEXT BOOKS:**

1. Gary Dessler and Biju Varkkey, “Human Resource Management”, Pearson, 16<sup>th</sup> Edition, 2020.
2. Mathis and Jackson, “Human Resource Management”, Cengage Learning, 15<sup>th</sup> Edition, 2017.

**REFERENCES:**

1. David A Decenzo, Stephen P Robbins, and Susan L Verhulst, “Human Resource Management”, Wiley, International Student Edition, 2014.
2. Aswathappa K, Sadhna Dash, “Human Resource Management - Text and Cases”, McGraw Hill, 10<sup>th</sup> Edition, 2023.
3. Luis R Gomez-Mejia, David B Balkin, Robert L Cardy, “Managing Human Resource”, PHI Learning, 2012

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	2	2	-	-	-	-	2	-	-	2	-
<b>CO2</b>	2	2	-	-	2	-	2	-	-	2	-
<b>CO3</b>	2	2	-	-	2	-	2	2	2	2	3
<b>CO4</b>	2	2	1	1	2	-	2	2	2	2	3
<b>CO5</b>	2	2	1	1	2	-	2	3	2	3	3

  
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**OBJECTIVES:****The student should be made to:**

- Understand the requirements, scope, and institutional support for setting up new ventures.
- Study the concepts, types, and challenges of venture financing
- Discuss the instruments and credit facilities involved in debt financing.
- Summarize the various equity-based funding options such as subsidies, angel investment, and venture capital.
- Explain the investor decision-making process and criteria for fund raising.

**UNIT I ESSENTIALS OF NEW BUSINESS VENTURE 9**

Setting up new Business Ventures – Need - Scope - Franchising - Location Strategy, Registration Process - State Directorate of Industries- Financing for New Ventures - Central and State Government Agencies - Types of loans – Financial Institutions - SFC, IDBI, NSIC and SIDCO.

**UNIT II INTRODUCTION TO VENTURE FINANCING 9**

Venture Finance – Definition – Historic Background - Funding New Ventures- Need – Scope – Types - Cost of Project - Means of Financing - Estimation of Working Capital - Requirement of funds – Mix of Debt and Equity - Challenges and Opportunities.

**UNIT III SOURCES OF DEBT FINANCING 9**

Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments – Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit Facilities - Cash Credit - Over Draft.

**UNIT IV SOURCES OF EQUITY FINANCING 9**

Own Capital, Unsecured Loan - Government Subsidies, Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowd funding- Venture Capital.

**UNIT V METHODS OF FUND RAISING FOR NEW VENTURES 9**

Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds - Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends.

**TOTAL: 45 PERIODS**

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**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Classify different types of financing agencies and loan facilities available.
- Calculate project cost, working capital, and mix of debt–equity for financing..
- Select appropriate debt sources to manage capital and working capital needs.
- Construct financing plans using equity-based funding alternatives.
- Develop strategies for approaching and negotiating with potential investors.

**TEXT BOOKS:**

1. Brealey and Myers., “Principles of Corporate Finance”, McGraw Hill Education (India) Private Limited, 12<sup>th</sup> Edition, 2018.
2. Prasanna Chandra, “Projects: Planning, Analysis, Selection, Financing, Implementation and Review”, McGraw Hill Education India Pvt Ltd, New Delhi, 2019.

**REFERENCES:**

1. Brad Feld and Jason Mendelson., “Venture Deals”, John Wiley & Sons, Inc., 3<sup>rd</sup> Edition, 2016.
2. Josh Lerner, Ann Leamon, and Felda Hardymon, “Venture Capital, Private Equity, and The Financing of Entrepreneurship”, 2023.
3. Thomas Byers, “Technology Ventures: From Idea to Enterprise”, McGraw Hill Higher Education, 2025.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	2	-	-	-	-	-	-	-	1	1	1
<b>CO2</b>	2	-	-	-	-	-	-	1	2	2	2
<b>CO3</b>	2	2	-	-	1	1	2	1	2	2	2
<b>CO4</b>	2	2	-	-	1	1	2	1	2	2	2
<b>CO5</b>	2	2	1	1	1	1	2	1	2	2	2

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**24M301 PRINCIPLES OF PUBLIC ADMINISTRATION  
(COMMON TO ALL BRANCHES)**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

Understand the nature of public administration.

- Learn the different functions of administration.
- Learn the different relationships and approaches.
- Understand the Bureaucratic and ecological approaches.
- Know about the leadership approaches, communication types and decision making process

**UNIT-I INTRODUCTION TO PUBLIC ADMINISTRATION 9**

1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration as a discipline
4. Public Administration and Governance

**UNIT-II ADMINISTRATIVE THEORIES AND APPROACHES 9**

1. Classical Approach – Henry Fayol, Luther Gulick
2. Scientific Management Approach – F.W. Taylor
3. Human Relations Approach – Elton Mayo
4. Bureaucratic Approach – Max Weber

**UNIT-III RELATIONSHIP AND CONTEXT 9**

1. Relationship of Public Administration with Political Science, History, Sociology, and Economics
2. Ecological Approach – F.W. Riggs
3. Comparative Public Administration
4. Role of Public Administration in Developing Countries

**UNIT-IV NEW TRENDS IN PUBLIC ADMINISTRATION 9**

1. New Public Administration (NPA)
2. New Public Management (NPM)
3. Governance and E-Governance
4. Public and Private Administration – Comparative Study

**UNIT-V LEADERSHIP, COMMUNICATION AND DECISION MAKING 9**

1. Leadership – Meaning, Styles and Theories
2. Communication – Types, Process, Barriers, Effective Communication in Administration
3. Decision Making – Concepts, Techniques and Models (Simon's Model, Rational and Participative Approaches)

**TOTAL: 45 PERIODS**

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## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the nature, scope, and importance of public administration.
- Illustrate the evolution and various approaches to public administration.
- Analyze relationships of administration with other social sciences.
- Interpret the principles of leadership, communication, and decision making.
- Assess the new trends in public administration and their practical implications.

## TEXT BOOKS:

1. Avasthi, A. and Maheshwari, S.R., "Public Administration." Lakshmi Narain Agarwal, 18<sup>th</sup> Edition, 2022.
2. Nicholas Henry, "Public Administration and Public Affairs." Routledge, 14<sup>th</sup> Edition, 2023.
3. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice." Kitab Mahal, 2021.

## REFERENCES:

1. Avasthi and Maheswari: Public Administration in India. Agra: Lakshmi Narain Agarwal, 2013.
2. Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.
3. R.B. Jain: Public Administration in India, 21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
4. Rumki Basu: Public Administration: Concept and Theories. New Delhi: Sterling, 2013.
5. R. Tyagi. Public Administration, Atma Ram & Sons, New Delhi, 1983.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	2	2	–	–	–	3	2	2	-	2	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	–	–	3	3	3	2	3	3

  
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24M302

**ELEMENTS OF PUBLIC ADMINISTRATION  
(COMMON TO ALL BRANCHES)**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the nature and role of public administration and the principles of good governance.
- Explore the interdisciplinary nature of public administration and key administrative approaches.
- Learn the foundational principles of organizational structure and administration.
- Understand administrative processes, leadership, and factors affecting organizational performance.
- Introduce personnel administration and the role of civil services in governance.

**UNIT I ADMINISTRATION IN MODERN SOCIETY**

**9**

Administration in Modern Society; Public and Private administration; Evolution of the study of Public Administration. Concept of good governance.

**UNIT II PUBLIC ADMINISTRATION AS A SOCIAL SCIENCE**

**9**

Public Administration as a social science; Relationship with other Social Sciences; Political Science, Economics, Sociology, Law and Psychology. Approaches to the study of Public Administration : Classical and Human Relation

**UNIT III PRINCIPLES OF ORGANIZATION**

**9**

Principles of Organisations : Hierarchy, Unity of command, Span of control, Coordination, Centralisation, Decentralisation, Authority and Responsibility; Formal and Informal Organisation.

**UNIT IV ADMINISTRATIVE PROCESSES**

**9**

Chief Executive, Line and Staff, Supervision, Delegation, Leadership, Communication, Decision making , Morale and Motivation .

**UNIT V PERSONNEL ADMINISTRATION**

**9**


Personnel Administration : Meaning and nature of Bureaucracy; Civil Services and their role in a developing society; Classification. Recruitment. Training, Promotion, Disciplinary action, code of conduct..

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Differentiate between public and private administration.
- Analyze the interdisciplinary aspects of public administration.
- Apply principles of organization in administrative systems.
- Evaluate administrative processes including leadership, communication, and decision-making.
- Explain personnel administration, civil services, and ethical responsibilities.

  
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### TEXT BOOKS

1. Avasthi. A. and Maheshwari. S.R.. "Public Administration." Lakshmi Narain Agarwal. 18<sup>th</sup> Edition. 2022.
2. M.P. Sharma and B.L. Sadana. "Public Administration in Theory and Practice." Kitab Mahal. 2021.
3. Nicholas Henry. "Public Administration and Public Affairs." Routledge. 14<sup>th</sup> Edition. 2023.

### REFERENCES:

- 1.F.W. Riggs. "Ecology of Public Administration." Asia Publishing House. 2021.
- Peter Self. "Administrative Theories and Politics." Routledge. 2nd Edition. 2019.
2. Dwivedi, O.P. and Gow. J.I., "From Bureaucracy to Public Management," Broadview Press, 2020.
3. L.D. White. "Introduction to the Study of Public Administration," Macmillan, Reprint Edition, 2020.

### MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	2	2	–	–	–	3	2	2	-	2	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	–	–	3	3	3	2	3	3

  
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24M303

**PUBLIC PERSONNEL ADMINISTRATION  
(COMMON TO ALL BRANCHES)**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the concept, scope, and significance of personnel administration in public administration.
- Learn the structure and functioning of civil services and bureaucracy.
- Study recruitment, training, promotion, and disciplinary mechanisms in public service.
- Understand the role of ethics, code of conduct, and accountability in personnel administration.
- Examine contemporary issues, challenges, and reforms in personnel management in government.

**UNIT-I INTRODUCTION TO PUBLIC PERSONNEL ADMINISTRATION 9**

1. Meaning, Nature, and Scope of Personnel Administration
2. Importance and Functions of Personnel Administration
3. Relationship between Personnel Administration and Public Administration
4. Principles of Effective Personnel Management

**UNIT-II BUREAUCRACY AND CIVIL SERVICES 9**

1. Bureaucracy: Meaning, Nature, and Features
2. Role of Civil Services in Governance and Development
3. Classification of Civil Services: Central and State Services
4. Functions and Responsibilities of Civil Servants

**UNIT-III RECRUITMENT AND TRAINING 9**

1. Recruitment: Methods and Procedures in Public Services
2. Selection Process and Entry-Level Requirements
3. Training and Development Programs for Civil Servants
4. Performance Appraisal and Career Development

**UNIT-IV PROMOTION, DISCIPLINE AND ACCOUNTABILITY 9**

1. Promotion Policies and Procedures in Public Services
2. Disciplinary Action: Principles and Procedures
3. Code of Conduct for Civil Servants
4. Accountability and Transparency in Public Personnel Administration

**UNIT-V CONTEMPORARY ISSUES AND REFORMS 9**

1. Challenges in Public Personnel Administration
2. Recruitment Reforms and Modernization of Civil Services
3. E-Governance and Digitalization in Personnel Management
4. International Best Practices and Comparative Perspectives

**TOTAL: 45 PERIODS**

  
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## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the nature, scope, and functions of public personnel administration
- Describe the role of bureaucracy and civil services in governance
- Analyze recruitment, training, and career development processes
- Evaluate promotion, disciplinary measures, and accountability mechanisms
- Assess contemporary challenges, reforms, and digitalization in personnel administration

## TEXT BOOKS

- 1.M.P. Sharma and B.L. Sadana. "Public Administration in Theory and Practice," Kitab Mahal, 2021.
- 2.Avasthi, A. and Maheshwari, S.R.. "Public Administration." Lakshmi Narain Agarwal, 18th Edition, 2022.
3. Nicholas Henry. "Public Administration and Public Affairs." Routledge, 14th Edition, 2023.

## REFERENCES:

- 1.F.W. Riggs. "Ecology of Public Administration." Asia Publishing House, 2021.
- 2.Peter Self. "Administrative Theories and Politics." Routledge, 2nd Edition, 2019.
- 3.Dwivedi, O.P., "Bureaucracy and Civil Services in India." Sterling Publishers, 2020.
- 4.L.D. White. "Introduction to the Study of Public Administration." Macmillan. Reprint Edition, 2020.

## MAPPING OF COs WITH POs

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CO3	2	3	2	–	–	3	2	3	-	3	3
CO4	2	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

  
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24M304

**ADMINISTRATIVE THEORIES  
(COMMON TO ALL BRANCHES)**

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3 0 0 3**

**OBJECTIVES:**

**The Student should be made to:**

- Understand the historical development and evolution of administrative thought.
- Learn classical, behavioral, and modern approaches to administration.
- Examine the contributions of key theorists in administrative theory.
- Understand organizational principles, processes, and structures.
- Analyze contemporary trends and emerging theories in public administration.

**UNIT I INTRODUCTION TO ADMINISTRATIVE THEORIES 9**

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration

**UNIT II CLASSICAL APPROACHES 9**

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

**UNIT III BEHAVIORAL APPROACHES 9**

Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.

**UNIT IV MODERN AND CONTEMPORARY APPROACHES 9**

Systems Theory, Contingency Approach, Total Quality Management (TQM), New Public Administration (NPA) and New Public Management (NPM)

**UNIT V ORGANIZATIONAL THEORY AND EMERGING TRENDS 9**

Organizational Culture and Climate, Network Governance and E-Governance, Knowledge Management in Administration, Comparative Public Administration and Global Practices.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the evolution and significance of administrative theories
- Compare classical administrative approaches and their relevance

  
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- Evaluate behavioral approaches including human relations and decision-making
- Analyze modern administrative theories and management techniques
- Assess organizational theories, emerging trends, and global practices

#### TEXT BOOKS:

1. M.P. Sharma and B.L. Sadana. "Public Administration in Theory and Practice." Kitab Mahal, 2021.
2. Avasthi, A. and Maheshwari, S.R., "Public Administration." Lakshmi Narain Agarwal, 18th Edition, 2022.
3. Nicholas Henry, "Public Administration and Public Affairs," Routledge, 14th Edition, 2023.

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- 2.Peter Self. "Administrative Theories and Politics," Routledge, 2nd Edition, 2019.
- 3.Dwivedi, O.P., "Bureaucracy and Civil Services in India," Sterling Publishers, 2020.
4. L.D. White, "Introduction to the Study of Public Administration," Macmillan, Reprint Edition, 2020.

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CO3	2	3	2	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

  
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**OBJECTIVES:****The Student should be made to:**

- Understand the structure, functions, and evolution of the Indian Administrative System.
- Learn about the Union and State governments, their institutions, and functioning.
- Understand the roles, powers, and responsibilities of civil servants in India.
- Examine administrative processes, decision-making, and accountability mechanisms in governance.
- Explore reforms, contemporary issues, and challenges in Indian administration.

**UNIT I INTRODUCTION TO INDIAN ADMINISTRATIVE SYSTEM 9**

Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

**UNIT II UNION GOVERNMENT AND ADMINISTRATION 9**

Structure and Functions of the Union Government, President, Prime Minister, Council of Ministers: Powers and Responsibilities, Parliament and its Role in Administration, Ministries and Departments: Functions and Coordination

**UNIT III STATE GOVERNMENT AND ADMINISTRATION 9**

Structure and Functions of State Governments, Governor, Chief Minister, State Council of Ministers: Powers and Responsibilities, State Legislature and Administrative Machinery, Local Self-Government: Panchayati Raj and Urban Local Bodies

**UNIT IV CIVIL SERVICES IN INDIA 9**

Bureaucracy: Meaning, Features, and Role in Governance, Union and State Civil Services: IAS, IPS, and Other Services, Recruitment, Training, Promotion, and Performance Evaluation, Accountability, Ethics, and Conduct of Civil Servants.

**UNIT V REFORMS AND CONTEMPORARY ISSUES 9**

Administrative Reforms: Recommendations and Implementation, E-Governance, Digital India, and Transparency Initiatives, Challenges in Indian Administration: Corruption, Red-Tapism, and Policy Implementation, Comparative Administrative Practices and Global Perspectives

**TOTAL: 45 PERIODS**

*M. Sharma*  
CHAIRMAN  
BOS/EC  
28/10/25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the evolution and constitutional basis of Indian administration
- Describe the structure, roles, and responsibilities of Union Government institutions
- Analyze state government structures and local self-governance mechanisms
- Explain the role, recruitment, and accountability of civil services in India
- Evaluate administrative reforms, e-governance, and contemporary challenges

## TEXT BOOKS

- 1.M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.
- 2.Avasthi, A. and Maheshwari, S.R., "Public Administration," Lakshmi Narain Agarwal, 18<sup>th</sup> Edition, 2022.
- 3.Laxmikanth, M., "Public Administration," McGraw-Hill, 2022.

## REFERENCES:

- 1.Subhash Kashyap, "Indian Administration," National Book Trust, 2020.
- 2.Peter Self, "Administrative Theories and Politics," Routledge, 2nd Edition, 2019.
- 3.F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.
- 4.Vig, N., "Indian Civil Services and Governance," Sage Publications, 2021.

## MAPPING OF COs WITH POs

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	3	2	-	–	–	2	2	2	-	2	2
CO3	2	3	2	-	-	3	2	3	2	3	3
CO4	3	2	2	-	-	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

  
CHAIRMAN  
BOS/ECE

**OBJECTIVES:****The Student should be made to:**

- Understand the concepts, nature, and scope of public policy and its role in governance.
- Learn the stages of policy formulation, implementation, and evaluation.
- Examine the role of institutions, bureaucracy, and leadership in policy-making.
- Analyze the tools and techniques for effective policy implementation.
- Evaluate contemporary policy issues, reforms, and challenges in governance

**UNIT-I INTRODUCTION TO PUBLIC POLICY 9**

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Publicpolicy relationship with social sciences especially with political science and Public Administration.

**UNIT-II POLICY FORMULATION 9**

Actors in Policy-Making: Government, Bureaucracy, Interest Groups, and Media- Stages of Policy Formulation: Agenda Setting, Policy Design, and Decision Making- Tools and Techniques for Policy Formulation- Challenges in Policy Formulation

**UNIT-III POLICY IMPLEMENTATION 9**

Bureaucracy and Policy Implementation- Administrative Structures and Coordination- Leadership and Decision-Making in Implementation- Obstacles to Effective Implementation: Red-Tapism, Corruption, and Resource Constraints

**UNIT-IV POLICY EVALUATION AND CONTROL 9**

Methods and Techniques of Policy Evaluation- Performance Measurement and Monitoring- Feedback Mechanisms and Policy Adjustments- Role of Legislative, Judicial, and Executive Oversight

**UNIT-V CONTEMPORARY ISSUES IN PUBLIC POLICY 9**

Social Policy: Health, Education, and Welfare Programs- Economic Policy: Fiscal, Monetary, and Industrial Policies- Environmental Policy and Sustainable Development- Policy Reforms, E-Governance, and Global Best Practices

**TOTAL: 45 PERIODS**

*M. Sharma*  
CHAIRMAN  
BOS/ECI  
28/10/25

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explain the nature, scope, and significance of public policy
- Analyze the stages and actors in policy formulation
- Describe policy implementation mechanisms and challenges
- Evaluate policy outcomes using methods and feedback mechanisms
- Assess contemporary policy issues, reforms, and best practices

**TEXT BOOKS:**

1. Thomas R. Dye, "Understanding Public Policy," Pearson, 15th Edition, 2020.
2. DeLeon, Public Policy: Theory and Practice, Routledge, 2nd Edition, 2019.
3. M.P. Sharma and B.L. Sadana, "Public Administration in Theory and Practice," Kitab Mahal, 2021.

**REFERENCES:**

1. James E. Anderson, "Public Policy: An Introduction to the Theory and Practice," Cengage, 9th Edition, 2021.
2. Subhash Kashyap, "Public Policy and Governance in India," National Book Trust, 2020.
3. Peter Hupe and Michael Hill, "Implementing Public Policy," Sage Publications, 2019.
4. F.W. Riggs, "Ecology of Public Administration," Asia Publishing House, 2021.

**MAPPING OF COs WITH POs**

Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	-	2	2	2	-	2	2
CO2	2	3	2	–	–	2	2	3	-	3	3
CO3	3	2	2	-	-	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3
CO5	3	2	2	2	3	3	3	3	2	3	3

  
CHAIRMAN  
BOS/EC

**OBJECTIVES:****The Student should be made to:**

- Understand basic probability and common types of distributions
- Learn how to take samples and estimate values for a population
- Use statistical tests like z-test, t-test, and ANOVA to test idea
- Know about different tests for analytics
- Find and explain relationships between two or more variable

**UNIT I INTRODUCTION 9**

Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

**UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9**

Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

**UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS 9**

Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

**UNIT IV NON-PARAMETRIC TESTS 9**

Chi-square tests for independence of attributes and goodness of fit, Kolmogorov-Smirnov - test for goodness of fit, Mann - Whitney U test and Kruskal Wallis test.

**UNIT V CORRELATION AND REGRESSION 9**

Correlation - Rank Correlation - Regression - Estimation of Regression line - Method of Least Squares - Standard Error of estimate.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (AD) 16/10/25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Facilitate objective solutions in distribution techniques
- Estimate population values from samples
- Test hypotheses using parametric methods
- Develop skill-set that is in demand in both the research and business environments
- Measure correlation and build regression lines

## TEXT BOOKS:

1. Richard I Levin, David S Rubin, Masood H Siddiqui, Sanjay Rastogi, "Statistics for Management", Pearson Education, 8<sup>th</sup> Edition, 2017.
2. Ken Black, "Applied Business Statistics", 7<sup>th</sup> Edition, Wiley India Edition, 2012.

## REFERENCES:

1. Prem S Mann, "Introductory Statistics". Wiley Publications, 9<sup>th</sup> Edition, 2015.
2. Srivastava T N and Shailaja Rego, "Statistics for Management". Tata McGraw Hill, 3<sup>rd</sup> Edition 2017.
3. David R Anderson, Dennis J Sweeney, Thomas A Williams, Jeffrey D Camm, James J Cochran, "Statistics for business and economics". 13<sup>th</sup> Edition, Thomson (South – Western) Asia, Singapore, 2016.
4. Vohra N D, "Business Statistics", Tata McGraw Hill, 2017.

## CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	2	2	2	-	2	2
CO2	2	2	2	-	-	2	1	1	-	2	2
CO3	2	2	1	-	-	2	-	2	-	2	2
CO4	2	2	2	-	-	1	1	1	-	2	2
CO5	2	2	2	-		1	-	2	-	1	2

  
CHAIRMAN  
BoS (AD)


**OBJECTIVES:****The Student should be made to:**

- Understand the basics of data mining and warehousing
- Learn different data mining processes and models
- Explore data visualization and time series methods
- Study techniques to group and classify data
- Understand key AI techniques used in data mining

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Data mining, Text mining, Web mining, Data ware house.		
<b>UNIT II</b>	<b>DATA MINING PROCESS</b>	<b>9</b>
Data mining process - KDD, CRISP-DM, SEMMA Prediction performance measures.		
<b>UNIT III</b>	<b>PREDICTION TECHNIQUES</b>	<b>9</b>
Data visualization, Time series - ARIMA, Winter Holts,		
<b>UNIT IV</b>	<b>CLASSIFICATION AND CLUSTERING TECHNIQUES</b>	<b>9</b>
Classification, Association, Clustering.		
<b>UNIT V</b>	<b>MACHINE LEARNING AND AI</b>	<b>9</b>
Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm Optimization		
<b>TOTAL: 45 PERIODS</b>		

**OUTCOMES:****On successful completion of this course, the students will be able to,**

- Identify the uses of data mining, text mining, web mining, and data warehouses
- Describe KDD, CRISP-DM, and SEMMA with prediction performance measures
- Apply ARIMA and Winter's method for time-based predictions
- Use classification, association, and clustering methods in data analysis
- Develop and implement machine learning algorithms

  
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 BoS (AD) 23/10/25

**TEXT BOOKS:**

1. Ralph Kimball and Richard Merz, "The data warehouse toolkit", John Wiley, 3rd Edition, 2013.
2. Galit Shmueli, Nitin R Patel and Peter C Bruce, "Data Mining for Business Intelligence-Concepts, Techniques and Applications", Wiley, India, 2010.

**REFERENCES:**

1. Jaiwei Ham and Micheline Kamber, "Data Mining concepts and techniques", Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, "Business Intelligence", Prentice Hall, 2008.
3. Inmon W H, "Building the Data Warehouse", fourth Edition Wiley India pvt. Ltd. 2005.
4. Michel Berry and Gordon Linoff, "Mastering Data mining", John Wiley and Sons Inc, 2nd Edition, 2011.
5. Michel Berry and Gordon Linoff, "Data mining techniques for Marketing", Sales and Customer support, John Wiley, 2011.
6. Gupta G K, "Introduction to Data mining with Case Studies", Prentice hall of India, 2011
7. Giudici, "Applied Data mining – Statistical Methods for Business and Industry", John Wiley, 2009.
8. Elizabeth Vitt, Michael Luckevich Stacia Misner, "Business Intelligence", Microsoft, 2011.
9. Michalewicz Z, Schmidt M Michalewicz M and Chiriac C, "Adaptive Business Intelligence", Springer Verlag, 2007.

**CO - PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	3	2	-	2	2	2	2
CO2	3	2	2	2	3	1	-	1	1	2	2
CO3	3	2	2	2	3	2	-	2	1	2	2
CO4	3	2	1	2	3	1	-	1	2	2	2
CO5	3	2	1	1	3	1	-	2	2	1	2

  
 CHAIRMAN  
 BoS (AD)

24M403

HUMAN RESOURCE ANALYTICS

L T P C

3 0 0 3

**OBJECTIVES:**

**The Student should be made to:**

- Understand the role of people analytics and HR metrics in business impact
- Learn key recruitment metrics and their use in hiring analysis
- Understand how to measure and evaluate training effectiveness
- Study analytics for employee engagement and internal career movement
- Explore metrics for workforce diversity and structure analysis

**UNIT I INTRODUCTION TO HR ANALYTICS 9**

People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business - HR metrics and KPIs.

**UNIT II HR ANALYTICS I: RECRUITMENT 9**

Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

**UNIT III HR ANALYTICS - TRAINING AND DEVELOPMENT 9**

Training & Development Metrics: Percentage of employees trained- Internally and externally trained-Training hours and cost per employee - ROI.


**UNIT IV HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION 9**

Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover - grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index- Rotation index - Career path index.

**UNIT V HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT 9**

Workforce Diversity and Development Metrics: Employees per manager - Workforce age profiling - Workforce service profiling - Churn over index - Workforce diversity index - Gender mix

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (AD) 16/10/25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain stages of HR analytics maturity and identify key HR KPIs
- Calculate and interpret metrics like time to hire, cost per hire, and quality of hire
- Apply training metrics such as training hours, cost per employee, and ROI
- Use metrics like retention index, promotion index, and career path index
- Analyze diversity using gender mix, churn rate, and age/service profilin

## TEXT BOOKS:

1. Edwards M R.. & Edwards K, "Predictive HR Analytics: Mastering the HR Metric". London: Kogan Page, 2016.
2. Dipak Kumar Bhattacharyya, "HR Analytics Understanding Theories and Applications". SAGE Publications India, 2017.

## REFERENCES:

1. Jac Fitzenz. "The New HR Analytics". AMACOM, 2010.
2. "Human Resources kit for Dummies". 3<sup>rd</sup> Edition, Max Messmer, 2003.
3. Sesil J C, "Applying advanced analytics to HR management decisions: Methods for selection, developing incentives, and improving collaboration. Upper Saddle River". New Jersey: Pearson Education, 2014.
4. Pease G. & Beresford B, "Developing Human Capital: Using Analytics to Plan and Optimize Your Learning and Development Investments". Wiley, 2014.
5. Phillips J, & Phillips P P, "Making Human Capital Analytics Work: Measuring the ROI of Human Capital Processes and OUTCOME". McGraw-Hill, 2014.
6. "HR Scorecard and Metrics". HBR, 2001.

## CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	2	-	1	2	2	2	2
CO2	2	2	2	2	1	-	1	1	1	2	2
CO3	2	1	2	1	1	-	1	2	1	2	2
CO4	2	1	1	2	1	-	1	1	2	2	2
CO5	2	1	2	1	1	-	1	2	2	1	2

  
CHAIRMAN  
BoS (AD)

**OBJECTIVES:**

**The Student should be made to:**

- Understand key marketing performance metrics and data analysis tools
- Learn how social media evolved and how it supports community engagement
- Understand social media ethics, privacy, and tracking methods
- Explore tools and methods for analyzing web data and business KPIs
- Study techniques to analyze and optimize online search and user behavior

**UNIT I      MARKETING ANALYTICS      9**

Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

**UNIT II      COMMUNITY BUILDING AND MANAGEMENT      9**

History and Evolution of Social Media - Understanding Science of Social Media - Goals for using Social Media - Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages - Linking Social Media Accounts-The Viral Impact of Social Media.

**UNIT III      SOCIAL MEDIA POLICIES AND MEASUREMENTS      9**

Social Media Policies - Etiquette, Privacy - ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.


**UNIT IV      WEB ANALYTICS      9**

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

**UNIT V      SEARCH ANALYTICS      9**

Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (AD) 16/10/25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Use techniques like market basket analysis and geo-mapping to interpret marketing data
- Identify social media goals, audiences, influencers, and promotional strategies
- Apply social media policies and measure platform performance responsibly
- Collect, interpret, and report web data to support digital strategy decisions
- Apply SEO, traffic analysis, and data visualization to improve online performance

## TEXT BOOKS:

1. Takeshi Moriguchi, "Web Analytics Consultant Official Textbook". 7<sup>th</sup> Edition, 2016.
2. Christian Fuchs, "Social Media a critical introduction", SAGE Publications Ltd, 2014.

## REFERENCES:

1. Shrivastava K M. "Social Media in Business and Governance". Sterling Publishers Private Limited, 2013.
2. Bittu Kumar. "Social Networking". V & S Publishers, 2013.
3. Avinash Kaushik. "Web Analytics An Hour a Day". Wiley Publishing, 2007.
4. Ric T Peterson. "Web Analytics Demystified". Celilo Group Media and Café Press 2004.

## CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	3	1	-	2	2	2	2
CO2	3	2	2	2	2	1	-	1	1	1	1
CO3	3	3	2	2	2	1	-	2	1	2	2
CO4	3	2	3	2	2	1	-	1	2	2	2
CO5	3	2	2	1	2	1	-	2	2	1	1

  
CHAIRMAN  
BoS (AD)

**OBJECTIVES:****The Student should be made to:**

- Understand types of analytics and their role in supply chains
- Learn models and methods for warehouse location and layout
- Study inventory models and risk management in supply chains
- Explore optimization algorithms for transportation and scheduling
- Understand multi-criteria decision-making techniques

**UNIT I INTRODUCTION 9**

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains - Basics, transforming supply chains.

**UNIT II WAREHOUSING DECISIONS 9**

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

**UNIT III INVENTORY MANAGEMENT 9**

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

**UNIT IV TRANSPORTATION NETWORK MODELS 9**

Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.

**UNIT V MCDM MODELS 9**

Analytic Hierarchy Process (AHP), Data Envelopment Analysis (DEA), Fuzzy Logic and Techniques, the analytical network process (ANP), TOPSIS.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (AD) 16/10/25

**OUTCOMES:**

On successful completion of this course, the students will be able to,

- Explain descriptive, predictive, and prescriptive analytics and their application in supply chain transformation
- Apply P-Median, LP, and heuristic approaches for warehouse space and layout decisions
- Implement lot sizing, multi-echelon inventory, and risk pooling strategies
- Solve problems using shortest path, maximal flow, traveling salesman, and scheduling algorithms
- Apply AHP, DEA, Fuzzy Logic, ANP, and TOPSIS in supply chain decisions

**TEXT BOOKS:**

1. Gerhard J Plenert. "Supply Chain Optimization through Segmentation and Analytics", CRC Press, Taylor & Francis Group, 2014.
2. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian. "Analytics in Operations/Supply Chain Management", I.K. International Publishing House Pvt. Ltd., 2016.

**REFERENCES:**

1. Nada R Sanders, "Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence", Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman. "Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain", Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H Masoumi, Ladimer S Nagurney. "Networks Against Time: Supply Chain Analytics for Perishable Products", Springer, 2013.

**CO - PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	-	-	-	2	1	2	2
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CO3	2	2	1	2	-	-	-	1	1	2	1
CO4	2	2	1	2	-	-	-	1	1	1	1
CO5	2	2	1	1	-	-	-	1	1	1	1

  
 CHAIRMAN  
 BoS (AD)

**OBJECTIVES:**

**The Student should be made to:**

- Understand financial modeling and capital budgeting techniques
- Learn risk and return estimation using time series models
- Explore portfolio management and option pricing models
- Use charting and indicators to predict stock prices
- Understand credit risk evaluation techniques

**UNIT I CORPORATE FINANCE ANALYSIS 9**

Basic corporate financial predictive modeling - Project analysis - cash flow analysis - cost of capital, Financial Break even modelling, Capital Budget model - Payback, NPV, IRR.

**UNIT II FINANCIAL MARKET ANALYSIS 9**

Estimation and prediction of risk and return (bond investment and stock investment) - Time series examining nature of data, Value at risk, ARMA, ARCH and GARCH.

**UNIT III PORTFOLIO ANALYSIS 9**

Portfolio Analysis - capital asset pricing model, Sharpe ratio, Option pricing models - binomial model for options, Black Scholes model and Option implied volatility.

**UNIT IV TECHNICAL ANALYSIS 9**

Prediction using charts and fundamentals - RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

**UNIT V CREDIT RISK ANALYSIS 9**

Credit Risk analysis - Data processing, Decision trees, logistic regression and evaluating credit risk model.

**TOTAL: 45 PERIODS**

  
CHAIRMAN  
BoS (AD) 16/10/25

## OUTCOMES:

On successful completion of this course, the students will be able to,

- Perform cash flow analysis and apply payback, NPV, and IRR methods
- Analyze bond and stock investments using ARMA, ARCH, GARCH models and Value at Risk
- Apply CAPM, Sharpe ratio, binomial and Black-Scholes models in portfolio analysis
- Analyze share prices using RSI, MACD, moving averages, and simulate trading strategies
- Build and evaluate credit risk models using decision trees and logistic regression

## TEXT BOOKS:

1. Yuxing Yan, "Python for Finance", Paperback - Import, 30 Jun 2017.
2. James Ma Weiming "Mastering Python for Finance Paperback", Import, 29 Apr 2015.

## REFERENCES:

1. Mark J Bennett, Dirk L Hugen, "Financial analytics with R", Cambridge University Press.
2. Pavel Ryzhov, "Haskell Financial Data Modeling and Predictive Analytics", Paperback – Import, 25 Oct 2013.
3. Edward E Williams, John A Dobelman "Quantitative Financial Analytics: The Path to Investment Profits Paperback", Import, 11 Sep 2017.

## CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	-	-	-	2	2	1	2
CO2	2	2	2	2	-	-	-	1	1	2	2
CO3	2	2	2	1	-	-	-	2	1	1	1
CO4	2	2	1	1	-	-	-	1	2	1	2
CO5	2	1	2	2	-	-	-	2	2	1	1

  
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BoS (AD)

<b>24M501</b>	<b>SUSTAINABLE INFRASTRUCTURE DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made to:**

- Gain knowledge on sustainable development goals and practices.
- Understand the concepts involved in sustainable infrastructure planning.
- Acquire knowledge on design, construction practices and techniques in construction.
- Explore the construction materials required for sustainable construction.
- Assess various measures for sustainable maintenance of infrastructure projects.

**UNIT I SUSTAINABLE DEVELOPMENT GOALS 9**


Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.

**UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING 9**

Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement & Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

**UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES 9**

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics –



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Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings

#### **UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS 9**

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

#### **UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS 9**

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand the environment sustainability goals at global and Indian scenario.
- Recognize risks in development of projects and suggest mitigation measures.
- Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
- Explain Life cycle analysis and life cycle cost of sustainable construction materials.
- Explore the new technologies adopted for maintenance of infrastructure projects.



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## REFERENCES:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
5. New Building Materials and Construction World magazine.
6. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
7. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009.
8. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union; 2010.
9. Greger Lundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-
CO4	2	-	2	-	-	2	-	-	-	-	-
CO5	2	-	-	-	-	2	-	-	-	2	-



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<b>24M502</b>	<b>SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Understand the issues of sustainability in agro ecology, agro ecosystem.
- Study soil health, soil erosion, control measures and suggest the management practices to improve soil nutrition.
- Explore the techniques needed for water management which leads to efficient storage system.
- Identify types and sources of agricultural wastes and suggest the suitable technologies for its sustainable management.
- Evaluate proper techniques adopted for sustainable food production.

**UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS** **9**

Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

**UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT** **9**

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

**UNIT III WATER MANAGEMENT** **9**

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

  
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**UNIT IV ENERGY AND WASTE MANAGEMENT** 9  
 Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

**UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS** 9  
 Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Explore the knowledge about the concepts, principles and advantages of sustainable agriculture.
- Discuss the sustainable ways in managing soil health, nutrients, pests and diseases.
- Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources.
- Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas.
- Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem.

**REFERENCES:**

1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020
3. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
4. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016
5. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021
6. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	3	-	-	-	-	-
CO2	2	-	-	-	-	3	-	-	-	1	-
CO3	2	-	-	-	-	3	-	-	-	1	-
CO4	2	-	-	-	-	3	-	-	-	1	-
CO5	2	-	-	-	-	3	-	-	-	-	-

  
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08.10.21

24M503

SUSTAINABLE BIO MATERIALS

L	T	P	C
3	0	0	3

**OBJECTIVES:**

**The student should be made to:**

- Impart knowledge on biomaterials and their properties.
- Recognize the fundamentals aspects, types of biopolymers and its applications.
- Learn about the properties of bio ceramics and bio composites.
- Discuss biomedical metals, with its types, properties and applications.
- Understand the significance of bionanomaterials and its applications.

**UNIT I INTRODUCTION TO BIOMATERIALS 9**


Introduction: Definition of biomaterials, requirements & classification of biomaterials- Types of Biomaterials- Degradable and resorbable biomaterials- engineered natural materials- Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types- crystal structure-imperfection in crystalline structure- surface properties and adhesion of materials –strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials

**UNIT II BIO POLYMERS 9**

Molecular structure of polymers -Molecular weight - Types of polymerization techniques– Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Polymethylmethacrylate (PMMA-Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers – Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications.

**UNIT III BIO CERAMICS AND BIOCOSITES 9**

General properties- Bio ceramics -Silicate glass - Alumina (Al<sub>2</sub>O<sub>3</sub>) -Zirconia (ZrO<sub>2</sub>)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites- Polymer Matrix Composite (PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)– glass ceramics - Orthopedic implants-Tissue engineering scaffolds



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**UNIT IV METALS AS BIOMATERIALS****9**

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys- Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

**UNIT V NANOBIMATERIALS****9**

Meatllic nanobiomaterials– Nanopolymers –Nanoceramics - Nanocomposites -Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize- nanofibres -Nano and micro features and their importance in implant performance- Nanosurface and coats-Applications nanoantibiotics - Nanomedicines- Biochips – Biomimetics - BioNEMs -Biosensor- Bioimaging/Molecular Imaging - challenges and future perspective.

**TOTAL : 45 PERIODS****OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Impart knowledge on surface properties, adhesion and performance of biomaterials.
- Analyze an overview of polymerization techniques, reactions of various biopolymers.
- Enhance the importance and properties of different bio ceramics and bio composite materials.
- Acquire knowledge on metals as biomaterials.
- Apply nano biomaterials in biomedical and other applications.

**REFERENCES:**

1. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad “Functional Bionanomaterials” springer, 2020.
2. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani “Introduction to Biomaterials Basic Theory with Engineering Applications” Cambridge University Press, 2014.
3. Donglu shi “Introduction to Biomaterials” Tsinghua University press, 2006.
4. Joon Park, R.S.Lakes “Biomaterials An Introduction” third edition, Springer 2007.
5. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh “Characterization of Biomaterials” Wood head publishing, 2013.
6. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science “An Introduction to Material in Medicine” Third Edition, 2013.
7. Leopoido Javier Rios Gonzalez. “Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process” Apple academic press, 2021.
8. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	2	3	-	-	-	-	-
CO4	3	-	-	-	2	3	-	-	-	-	-
CO5	3	-	-	-	2	3	-	-	-	-	-



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#### UNIT IV PHOTOVOLTAICS

9

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells – thin film silicon solar cells – multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se<sub>2</sub> solar cells – Cadmium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells - Materials used in solar cells ( metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials - copper-phthalocyanine and perylenetetracarboxylicbis -benzine – fullerenes - boron subphthalocyanine- tin (II) phthalocyanine).

#### UNIT V SUPERCAPACITORS

9

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell- parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

**TOTAL : 45 PERIODS**

#### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Acquire knowledge about various sources of energy sustainability.
- Understand the principles of different electrochemical devices.
- Examine the working principle of fuel cells and their applications.
- Summarize the various photovoltaic applications and the materials used.
- Gain knowledge on different types of supercapacitors and the performance of various materials.



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## REFERENCES:

1. Electrode Materials for Supercapacitors: A Review of Recent Advances, Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, catalysts 2020.
2. Recent advances, practical challenges, and perspectives of intermediate temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and Venkataraman Thangadurai, J. Mater. Chem. A, 2022.
3. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
4. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.
5. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
6. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
7. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh
8. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, Materials Today: Proceedings, 2022.

## Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	1	3	-	-	-	-	-
CO2	3	-	-	-	1	2	-	-	-	-	-
CO3	3	-	-	-	1	2	-	-	-	-	-
CO4	3	-	-	-	1	2	-	-	-	-	-
CO5	3	-	-	-	1	2	-	-	-	-	-

  
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24M505

**GREEN TECHNOLOGY**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

**The student should be made to:**

- Acquire knowledge on green chemistry and its applications.
- Identify the types of pollution and its sources.
- Classify solvents, green reagents and study the design process of chemical and microwave methods.
- Interpret the real time analysis for prevention of pollution and to provide green engineering solutions to reduce carbon foot print.
- Infer knowledge on nano materials and green nano technology.

**UNIT I PRINCIPLES OF GREEN CHEMISTRY 9**

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

**UNIT II POLLUTION TYPES 9**

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

**UNIT III GREEN REAGENTS AND GREEN SYNTHESIS 9**

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

**UNIT IV DESIGNING GREEN PROCESSES 9**

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention.



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## UNIT V GREEN NANOTECHNOLOGY

9

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Understand the principles of green engineering and technology.
- Learn different types of waste, chemical, physical and biochemical methods of waste minimization.
- Modify processes and products to make them green and safe through green synthesis and green reagents.
- Design safe products through green process to prevent pollution using green technology.
- Apply advanced green nanotechnology in green synthesis to reduce environmental impacts.

### TEXT BOOKS:

1. Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, 1997
2. Green Chemistry – An introductory text - M. Lancaster, RSC, 2016.
3. Green chemistry metrics - Alexi Lapkin and david Constable (Eds) ,Wiley publications,2008

### REFERENCES:

1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	2	3	-	-	-	-	-

  
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28.10.19

<b>24M506</b>	<b>ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Understand the concepts of environmental monitoring and standards.
- Study the complexity of the environmental parameters through monitoring programme.
- Analyze the organic pollutants and quality through environmental analysis and monitoring by proper methods.
- Evaluate environmental monitoring programme and risk assessment.
- Identify the automated data acquisition for process monitoring and control.

**UNIT I ENVIRONMENTAL MONITORING AND STANDARDS 9**

Introduction- Environmental Standards- Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India- Ambient air quality standards- water quality standard- Environmental Monitoring-Need for environmental monitoring- Concepts of environmental monitoring- Techniques of Environmental Monitoring.

**UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS 9**

Current Environmental Issues- Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.

**UNIT III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING 9**

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

  
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**UNIT IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT**

9

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol - Process of risk assessment- hazard identification-exposure assessment- dose-response assessment - risk characterization.

**UNIT V AUTOMATED DATA ACQUISITION AND PROCESSING**

9

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control - regulatory overview.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the students will be able to,**

- Understand environmental quality standards in India.
- Analyze current environmental issues, sampling methods and monitoring techniques.
- Identify the various instrumental methods and their principles for environmental monitoring.
- Enrich the significance of environmental standards through environmental monitoring programme.
- Study types and systems of data acquisition systems and processing.

**TEXTBOOKS:**

1. Environmental monitoring Handbook, Frank R. Burden, 2002 by The McGraw-HillCompanies, Inc.
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / Pradyot Patnaik, 1997 by CRC Press, Inc

**REFERENCES:**

1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.
2. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
3. Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	2	-	-	-	-
CO2	2	-	-	-	1	2	-	-	-	-	-
CO3	2	-	-	-	1	2	-	-	-	-	-
CO4	2	-	-	-	-	2	-	-	-	-	-
CO5	2	2	-	-	-	2	-	-	-	-	-

  
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<b>24M507</b>	<b>INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT</b>	<b>L T P C 3 0 0 3</b>
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**OBJECTIVES:**

**The student should be made to:**

- Create awareness on the energy scenario of India with respect to world.
- Understand the fundamentals of energy sources, energy efficiency and environmental standards.
- Familiarization on the concept of sustainable development goal and its benefits.
- Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development.
- Identify the suitable energy policies for sustainable development.

**UNIT I ENERGY SCENARIO 9**

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

**UNIT II ENERGY AND ENVIRONMENT 9**

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

**UNIT III REMEDIAL OPTIONS 9**

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG)  
-Social development: Poverty, conceptual issues and measures, impact of poverty.  
Globalization and Economic growth - Economic development: Economic inequalities, Income and growth.

**UNIT IV RENEWABLE ENERGY TECHNOLOGY 9**

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits.



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## UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

National & State Energy Policy - National solar mission - Framework of Central Electricity Authority- National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Road map for ethanol blending, Energy Efficiency and Energy Mix

**TOTAL: 45 PERIODS**

### OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand the world and Indian energy scenario.
- Analyse energy projects, its impact on environment and suggest control strategies.
- Recognise the need of sustainable development and its impact on human resource development
- Apply renewable energy technologies for sustainable development.
- Categorize energy policies and planning for sustainable development.

### REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at <http://www.emea.org/gbook1.asp>, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Robert Ristirer and Jack P. Kraushaar, "Energy and the environment", Willey, 2005.
3. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012
4. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.
5. Dhandapani Alagiri, Energy Security in India Current Scenario, The ICFAI University Press,2006.
6. M.H. Fulekar, Bhawana Pathak,R K Kale, "Environment and Sustainable Development" Springer,2016
7. <https://www.niti.gov.in/verticals/energy>

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-
CO5	2	-	-	-	-	2	2	-	-	-	-

  
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<b>24M508</b>	<b>ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made to:**

- Understand the types of energy sources, energy efficiency and environmental implications of energy utilization.
- Create awareness on energy audit and its impacts.
- Categorize the techniques adopted for performance evaluation of energy efficiency in thermal utilities.
- Familiarize on the procedures adopted for energy conservation in electrical utilities.
- Identify the concepts of attaining sustainable development and social development goals.

**UNIT I ENERGY AND ENVIRONMENT 9**

Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

**UNIT II ENERGY AUDITING 9**


Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

**UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9**

Energy conservation avenues in steam generation and utilization, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermo compression.

**UNIT IV ENERGY CONSERVTION IN ELECTRICAL UTILITIES 9**

Demand side management - Power factor improvement – Energy efficient transformers – Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers



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## UNIT V SUSTAINABLE DEVELOPMENT

9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On successful completion of this course, the students will be able to,**

- Gain knowledge on the prevailing energy scenario.
- Familiarise on energy audits and its relevance.
- Apply the concept of energy efficiency on thermal utilities.
- Identify the energy efficient conservation techniques in various electrical utilities.
- Explore sustainable development and its impact on human resource development.

### REFERENCES:

1. Energy Manager Training Manual (4 Volumes) available at <http://www.emea.org/gbook1.asp>, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004
2. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4<sup>th</sup> Edition, Wiley, 2022
3. Eastop. T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, ISBN-0-582-03184, 1990
4. W.R. Murphy and G. McKay "Energy Management" Butterworths, London 1987
5. Pratap Bhattacharyya, "Climate Change and Greenhouse Gas Emission", New India Publishing Agency- Nipa, 2020
6. Matthew John Franchetti, Defne Apul "Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies" CRC Press, 2012
7. M.H. Fulekar, Bhawana Pathak, R K Kale, "Environment and Sustainable Development" Springer, 2016
8. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	2	-	-	-	-	-
CO2	3	-	-	-	-	2	3	-	-	-	-
CO3	3	-	-	-	-	2	-	-	-	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-
CO5	3	-	-	-	-	2	-	-	-	-	-

  
CHAIRMAN  
BoS (CIVIL)