Kongunadu College of Engineering and Technology

(Autonomous)

Affiliated to Anna University, Chennai

B.E - Agriculture Engineering (2021-22 admitted students)

B.Tech - Agricultural Engineering (2022-23 onward admitted students)

Regulations: KNCET-UGR2020 Choice Based Credit System

I to VIII Semesters Curricula & Syllabi

Semester I

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20EN101	Technical English-I	HSMC	3	0	0	3
2	20MA101	Mathematics-I	BSC	3	1	0	4
3	20PH101	Engineering Physics	BSC	3	0	0	3
4	20CY101	Engineering Chemistry	BSC	3	0	0	3
5	20GE101	Structured Programming Using C	ESC	3	0	0	3
6	20GE102	Engineering Graphics	ESC	2	0	2	3
7	20TA101*	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1
Practicals							
8	20BS101L	Physics and Chemistry Laboratory	BSC	0	0	2	1
9	20GE103L	Structured Programming Using C Laboratory	ESC	0	0	2	1
10	20EEC101L	English for Effective Communication	EEC	0	0	2	1
			Total	**18**	**1**	**8**	**23**

Semester II

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20EN201	Technical English-II	HSMC	3	0	0	3
2	20MA201	Mathematics-II	BSC	3	1	0	4
3	20BS201	Environmental Science	HSMC	3	0	0	3
4	20BE202	Basic Electrical and Electronics Engineering	ESC	3	0	0	3
5	20AG201	Principles and Practices of Crop Production	PCC	3	0	0	3
6	20AG202	Fluid Mechanics and Hydraulics	PCC	3	0	0	3
7	20TA201**	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1
Practicals							
8	20GE201L	Engineering Practices Laboratory	ESC	0	0	2	1
9	20AG203L	Crop Husbandry Field Laboratory	PCC	0	0	2	1
10	20ME406L	Fluid Mechanics and Machinery Laboratory	PCC	0	0	2	1
11	20EEC201L	Soft Skills	EEC	0	0	2	1
			Total	**19**	**1**	**8**	**24**

* - Exempted for 2021-22 admitted students & in Semester II for the 2022-23 admitted students

** - Exempted for 2021-22 admitted students & in Semester III for the 2022-23 admitted students

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Semester III							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20MA302	Transforms and Partial Differential Equations	BSC	3	1	0	4
2	20AG301	Thermodynamics and Heat Transfer	PCC	3	0	0	3
3	20AG302	Strength of Materials and Engineering Mechanics	PCC	3	0	0	3
4	20CE303	Surveying	PCC	3	0	0	3
5	20EC308	Electronics and Microprocessors	ESC	3	0	2	4
6	20MC002	Universal Human Values 2: Understanding Harmony	MC	3	0	0	3
Practicals							
7	20CE406L	Strength of Materials Laboratory	PCC	0	0	2	1
8	20CE306L	Surveying Laboratory	PCC	0	0	2	1
9	20EEC301L	Soft Skills Development	EEC	0	0	2	1
			Total	**18**	**1**	**8**	**23**

Semester IV							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20MA404	Probability and Statistics	BSC	3	1	0	4
2	20AG401	Unit Operations in Agricultural Processing	PCC	3	0	0	3
3	20AG402	Farm Tractors	PCC	3	0	0	3
4	20AG403	Theory of Machine and Machine Elements Design	PCC	3	0	0	3
5	20AG404	Soil Science and Engineering	PCC	3	0	0	3
6	20EC407	Introduction to Sensors and Actuators	ESC	3	0	0	3
7	20MC003	Constitution of India	MC	2	0	0	0
Practicals							
8	20AG405L	Soil Science Laboratory	PCC	0	0	2	1
9	20EC408L	Sensors and Actuators Laboratory	ESC	0	0	3	1
10	20EEC401L	Life Skills and Personality Development	EEC	0	0	2	1
			Total	**20**	**1**	**7**	**22**

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Semester V							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20AG501	Irrigation and Drainage Engineering	PCC	3	0	0	3
2	20AG502	Farm Machinery and Equipments	PCC	3	0	0	3
3	20ME505PE	Refrigeration and Air Conditioning	PCC	3	0	0	3
4	20EC701	Embedded and Real Time Systems	ESC	3	0	0	3
5		Professional Elective I	PEC	3	0	0	3
6		Open Elective I	OEC	3	0	0	3
Practicals							
7	20AG503L	Irrigation Field Laboratory	PCC	0	0	3	1
8	20EC703L	Embedded Laboratory	ESC	0	0	3	1
9	20EEC501L	Professional Skills Development	EEC	0	0	2	1
			Total	**18**	**0**	**8**	**21**

Semester VI							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20AG601	Groundwater and Well Engineering	PCC	3	0	0	3
2	20AG602	Post Harvest Technology	PCC	3	0	2	4
3	20AG603	Soil and Water Conservation Engineering	PCC	3	0	0	3
4	20EC606	IoT in Agricultural Engineering	ESC	3	0	0	3
5		Professional Elective II	PEC	3	0	0	3
Practicals							
6	20EC607L	Internet of Things Laboratory	ESC	0	0	3	1
7	20AG604L	Mini Project-I	EEC	0	0	2	1
8	20EEC601L	Employability Skills	EEC	0	0	2	1
			Total	**15**	**0**	**9**	**19**

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Semester VII							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1	20AG701	Remote Sensing and Geographical Information System	PCC	3	0	0	3
2	20AG702	Renewable Energy in Agricultural Engineering	PCC	3	0	0	3
3		Professional Elective III	PEC	3	0	0	3
4		Professional Elective IV	PEC	3	0	0	3
5		Open Elective II	OEC	3	0	0	3
Practicals							
6	20AG703L	Remote Sensing and GIS Laboratory	PCC	0	0	2	1
7	20AG704L	Renewable Energy Laboratory	PCC	0	0	2	1
8	20AG705L	Mini Project-II	EEC	0	0	2	1
9	20AG706L	Industrial Training (2 weeks During VI Semester - Summer)	EEC	0	0	0	1
			Total	**15**	**0**	**6**	**19**

Semester VIII							
S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
Theory							
1		Professional Elective V	PEC	3	0	0	3
2		Professional Elective VI	PEC	3	0	0	3
Practicals							
3	20AG801L	Project Work	EEC	0	0	20	10
		Total		**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS: 167

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

S. No	Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
	Processing and Food Engineering	**Farm Machinery and Management**	**Water Management and Protected Cultivation**	**Smart Agriculture and Safety**	**Renewable Energy Engineering**	**Agricultural Business and Entrepreneurship**
1	Fundamentals of Food Process Engineering	Farm Power and Machinery Management	Hydrology and Water Resources Engineering	Systems Analysis and Soft Computing in Agriculture Engineering	Biochemical and Thermochemical conversion of biomass	Total Quality Management
2	Process Engineering of Fruits and Vegetables	Farm Engines	Climate Change and Adaptation for Agriculture	IT in Agriculture Systems	Solar Energy Engineering and Technology	Agricultural Business Management
3	Food and Dairy Engineering	Farm Structures and Green House Technology	On Farm Water Management	Automation in Irrigation	Wind Energy Technology	Sustainable Agriculture and Food Security
4	Seed Processing Technology	Special Farm Equipment	Watershed Management	Machine Learning for Soil and Crop Management	Energy Conservation and Waste Heat Recovery	Foundation Skills in Integrated Product Development
5	Storage and Packaging Technology	Testing and Evaluation of Farm Machinery and Equipment	Natural Resources Management	Drone Technology for Agriculture	Energy Management and Auditing	Entrepreneurship Essentials
6	Food Process Equipment and Design	Human Engineering and Safety in Farm Machinery Operations	Micro Irrigation Engineering	Robotics	Waste and By-product Utilization	Intellectual Property Rights
7	Novel Technologies for Food Processing and Shelf Life Extension	Agricultural Economics and Farm Management	Protected Cultivation	Occupational Safety and Health in Agriculture	Energy Economics and Policies	Organic Farming for Sustainable Agricultural Production

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, provided one course is enrolled in Semester V and another in semester VI, VII and VIII.
- 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.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: PROCESSING AND FOOD ENGINEERING

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20AG101PE	Fundamentals of Food Process Engineering	PEC	3	0	0	3
2	20AG103PE	Process Engineering of Fruits and Vegetables	PEC	3	0	0	3
3	20AG102PE	Food and Dairy Engineering	PEC	3	0	0	3
4	20AG104PE	Seed Processing Technology	PEC	3	0	0	3
5	20AG105PE	Storage and Packaging Technology	PEC	3	0	0	3
6	20AG106PE	Food Process Equipment and Design	PEC	3	0	0	3
7	20AG107PE	Novel Technologies for Food Processing and Shelf Life Extension	PEC	3	0	0	3

VERTICAL II: FARM MACHINERY AND MANAGEMENT

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20AG201PE	Farm Power and Machinery Management	PEC	3	0	0	3
2	20AG202PE	Farm Engines	PEC	3	0	0	3
3	20AG203PE	Farm Structures and Green House Technology	PEC	3	0	0	3
4	20AG204PE	Special Farm Equipment	PEC	3	0	0	3
5	20AG205PE	Testing and Evaluation of Farm Machinery and Equipment	PEC	3	0	0	3
6	20AG206PE	Human Engineering and Safety in Farm Machinery Operations	PEC	3	0	0	3
7	20AG207PE	Agricultural Economics and Farm Management	PEC	3	0	0	3

VERTICAL III: WATER MANAGEMENT AND PROTECTED CULTIVATION

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20AG302PE	Hydrology and Water Resources Engineering	PEC	3	0	0	3
2	20AG301PE	Climate Change and Adaptation for Agriculture	PEC	3	0	0	3
3	20AG305PE	On Farm Water Management	PEC	3	0	0	3
4	20AG304PE	Watershed Management	PEC	3	0	0	3
5	20AG303PE	Natural Resources Management	PEC	3	0	0	3
6	20AG306PE	Micro Irrigation Engineering	PEC	3	0	0	3
7	20AG307PE	Protected Cultivation	PEC	3	0	0	3

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VERTICAL IV: SMART AGRICULTURE AND SAFETY

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20AG401PE	Systems Analysis and Soft Computing in Agriculture Engineering	PEC	3	0	0	3
2	20AG402PE	IT in Agriculture Systems	PEC	3	0	0	3
3	20AG403PE	Automation in Irrigation	PEC	3	0	0	3
4	20AG404PE	Machine Learning for Soil and Crop Management	PEC	3	0	0	3
5	20AG405PE	Drone Technology for Agriculture	PEC	3	0	0	3
6	20ME804PE	Robotics	PEC	3	0	0	3
7	20AG406PE	Occupational Safety and Health in Agriculture	PEC	3	0	0	3

VERTICAL V: RENEWABLE ENERGY ENGINEERING

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20AG501PE	Biochemical and Thermochemical Conversion of Biomass	PEC	3	0	0	3
2	20EE604PE	Solar Energy Engineering and Technology	PEC	3	0	0	3
3	20AG502PE	Wind Energy Technology	PEC	3	0	0	3
4	20AG503PE	Energy Conservation and Waste Heat Recovery	PEC	3	0	0	3
5	20EE503OE	Energy Management and Auditing	PEC	3	0	0	3
6	20AG504PE	Waste and By-product Utilization	PEC	3	0	0	3
7	20AG505PE	Energy Economics and Policies	PEC	3	0	0	3

VERTICAL VI: AGRICULTURAL BUSINESS AND ENTREPRENEURSHIP

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20MG701	Total Quality Management	PEC	3	0	0	3
2	20AG603PE	Agricultural Business Management	PEC	3	0	0	3
3	20AG602PE	Sustainable Agriculture and Food Security	PEC	3	0	0	3
4	20AG601PE	Foundation Skills in Integrated Product Development	PEC	3	0	0	3
5	20MG801PE	Entrepreneurship Essentials	PEC	3	0	0	3
6	20GE501PE	Intellectual Property Rights	PEC	3	0	0	3
7	20AG604PE	Organic Farming for Sustainable Agricultural Production	PEC	3	0	0	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)

Open Elective I (Semester-V)

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20BM501OE	Basics of Biomedical Instrumentation	OEC	3	0	0	3
2	20BM502OE	Introduction to Cell Biology	OEC	3	0	0	3
3	20CE501PE	Industrial Waste Management	OEC	3	0	0	3
4	20CE502PE	Air Pollution and Control Engineering	OEC	3	0	0	3
5	20CE602OE	Smart Materials and Smart Structures	OEC	3	0	0	3
6	20CS501OE	Fundamentals of Software Engineering	OEC	3	0	0	3
7	20CS507OE	Introduction to Data Structures and Algorithms	OEC	3	0	0	3
8	20EE502OE	Industrial Automation	OEC	3	0	0	3
9	20IT501OE	Fundamentals of Operating Systems	OEC	3	0	0	3
10	20IT502OE	Introduction to Database	OEC	3	0	0	3
11	20ME601OE	Production Technology	OEC	3	0	0	3
12	20AD601OE	Machine Learning	OEC	3	0	0	3

Open Elective II (Semester-VII)

S. No	Course Code	Course Title	Course Category	No of Hours / Week			Credit
				L	T	P	
1	20BM701OE	Bioinformatics	OEC	3	0	0	3
2	20BM702OE	Fundamentals of Nutrition	OEC	3	0	0	3
3	20CE701OE	Environmental Impact Assessment	OEC	3	0	0	3
4	20CE702OE	Building Services	OEC	3	0	0	3
5	20CS706OE	E-Commerce	OEC	3	0	0	3
6	20EC701OE	Consumer Electronics	OEC	3	0	0	3
7	20EC702OE	RFID and Flexible Sensors	OEC	3	0	0	3
8	20IT701OE	Programming in JAVA	OEC	3	0	0	3
9	20EE702PE	Industrial Safety Engineering	OEC	3	0	0	3
10	20AD701OE	Introduction to Artificial Intelligence	OEC	3	0	0	3
11	20IT702OE	Web Design	OEC	3	0	0	3
12	20ME701OE	Basics of Hydraulic and Pneumatic Systems	OEC	3	0	0	3

V. Gode
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27/9/23

SUMMARY

S.NO	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	7	3	0	0	0	0	0	14
2	BSC	11	4	4	4	0	0	0	0	23
3	ESC	7	4	4	4	4	4	0	0	27
4	PCC	0	8	11	13	10	10	8	0	60
5	PEC	0	0	0	0	3	3	6	6	18
6	OEC	0	0	0	0	3	0	3	0	6
7	EEC	1	1	1	1	1	2	2	10	19
8	Non Credit / Mandatory				#					0
	TOTAL	23	24	23	22	21	19	19	16	167

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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 FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5
Fintech and Block Chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**
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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(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 1: FINTECH AND BLOCK CHAIN

S. No	Course Code	Course Title	Course Category	No. of Hours/Week			Credit
				L	T	P	
1	20M101	Financial Management	PEC	3	0	0	3
2	20M102	Fundamentals of Investment	PEC	3	0	0	3
3	20M103	Banking, Financial Services and Insurance	PEC	3	0	0	3
4	20M104	Introduction to Blockchain and its Applications	PEC	3	0	0	3
5	20M105	Fintech Personal Finance and Payments	PEC	3	0	0	3
6	20M106	Introduction to Fintech	PEC	3	0	0	3

VERTICAL 2: ENTREPRENEURSHIP

S. No	Course Code	Course Title	Course Category	No. of Hours/Week			Credit
				L	T	P	
1	20M201	Foundations of Entrepreneurship	PEC	3	0	0	3
2	20M202	Team Building and Leadership Management for Business	PEC	3	0	0	3
3	20M203	Creativity and Innovation in Entrepreneurship	PEC	3	0	0	3
4	20M204	Principles of Marketing Management for Business	PEC	3	0	0	3
5	20M205	Human Resource Management for Entrepreneurs	PEC	3	0	0	3
6	20M206	Financing New Business Ventures	PEC	3	0	0	3

VERTICAL 3: PUBLIC ADMINISTRATION

S. No	Course Code	Course Title	Course Category	No. of Hours/Week			Credit
				L	T	P	
1	20M301	Principles of Public Administration	PEC	3	0	0	3
2	20M302	Elements of Public Administration	PEC	3	0	0	3
3	20M303	Public Personnel Administration	PEC	3	0	0	3
4	20M304	Administrative Theories	PEC	3	0	0	3
5	20M305	Indian Administrative System	PEC	3	0	0	3
6	20M306	Public Policy Administration	PEC	3	0	0	3

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VERTICAL 4: BUSINESS DATA ANALYTICS

S. No	Course Code	Course Title	Course Category	No. of Hours/Week			Credit
				L	T	P	
1	20M401	Statistics for Management	PEC	3	0	0	3
2	20M402	Data Mining for Business Intelligence	PEC	3	0	0	3
3	20M403	Human Resource Analytics	PEC	3	0	0	3
4	20M404	Marketing and Social Media Web Analytics	PEC	3	0	0	3
5	20M405	Operation and Supply Chain Analytics	PEC	3	0	0	3
6	20M406	Financial Analytics	PEC	3	0	0	3

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

S. No	Course Code	Course Title	Course Category	No. of Hours/Week			Credit
				L	T	P	
1	20M501	Sustainable Infrastructure Development	PEC	3	0	0	3
2	20M502	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3
3	20M503	Sustainable Bio Materials	PEC	3	0	0	3
4	20M504	Materials for Energy Sustainability	PEC	3	0	0	3
5	20M505	Green Technology	PEC	3	0	0	3
6	20M506	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3
7	20M507	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3
8	20M508	Energy Efficiency for Sustainable Development	PEC	3	0	0	3

V.Gopal
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20EN101	TECHNICAL ENGLISH I (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Enable learners develop basic communication skills in English
- Enhance the speaking skills for academic, professional and social purposes
- Enable learners make 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 SHARING INFORMATION **9**

Listening: Intensive and Extensive Listening – Barriers to Effective Listening, Speaking: Descriptions, Reading: Skimming and Scanning, Writing: Sentence completion – Autobiographical writing (writing about one's leisure time activities, hometown, etc.), Grammar: Parts of speech, Vocabulary: Word formation.

UNIT II INTRODUCTION TO WRITING **9**

Listening: Listening lectures/talks, Speaking: Telephonic interview, Reading: Inferring inferential and contextual meaning from literary texts, Writing: Biographical writing – Writing a paragraph (Cause and Effect/Compare and Contrast/Narrative/Analytical) – Writing a set of recommendations – Writing a set of instructions, Grammar: Prepositions – Active and Passive voice - Present Tense, Vocabulary: Confused Words.

UNIT III IMPROVING SPEAKING **9**

Listening: Listening to talks by eminent personalities – Focused audio tracks, Speaking: Role Play – Simulation – Group Interaction, Reading: Reading magazines, Writing: Business Letter (Order/Acceptance), Grammar: Past tense – Tag Questions – Subject – Verb Agreement, Vocabulary: Learning Words in Situations.

UNIT IV READING SKILLS **9**

Listening: Techniques for Effective Listening, Speaking: Speaking in job Interviews, Reading: Reading for factual and inferential meaning, Writing: Interpreting Visual Materials (Line Graphs, Pie Charts etc.), Grammar: Adverbs – Future Tense, Vocabulary: Single word substitutes.

UNIT V PRONUNCIATION **9**

Listening: Understanding different Accents, Listening to Radio and TV and taking notes, Speaking: Giving impromptu talks – Making presentations, Reading: Practice in speed reading, Writing: Business Letter (enquiry/Rejection), Grammar: Direct and Indirect Speech, Vocabulary: Phrasal Verbs.

TOTAL: 45 PERIODS

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OUTCOMES:

On successful completion of this 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, 2011.

REFERENCES:

1. Dutt P Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2013.
2. Redston Chris and Gillies Cunningham, "Face2Face (Pre-Intermediate Student's Book and Workbook", Cambridge University Press, New Delhi, 2005.
3. Perumal Lakshmana N and Sathiseelan S, "Technical English-I", Sri Krishna Hitech Publishing Company Pvt.Ltd, Chennai, 2014.
4. Mohan Krishna and Banerji Meera, "Developing Communication Skills", Macmillan Publishers India Ltd., Delhi, 2009.
5. Hewings Martin, "Advanced English Grammar: A Self Study Reference and Practice Book for Advanced South Asian Students", Cambridge University Press, New Delhi, 1999.

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20MA101	MATHEMATICS-I (COMMON TO ALL BRANCHES)	L T P C 3 1 0 4

OBJECTIVES:

The Student should be made to:

- Develop the use of matrix algebra technique for practical application
- Apply the properties of arithmetic and geometric in sequences and series
- Familiarize the students with differential calculus
- Familiarize the student with functions of several variables, this is needed in many branches of engineering
- Acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCE AND SERIES **12**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III DIFFERENTIAL CALCULUS **12**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules – Maxima and Minima of functions of one variable – Local maximum and minimum – absolute minimum and absolute maximum – increasing and decreasing – Concavity and inflection points – Rolle's theorem and mean value theorem(excluding proofs).

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **12**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS **12**

Double integrals in Cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Triple integrals – Volume of Solids: Volume as triple integral – Cylindrical coordinates – Spherical coordinates

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Eigen values and eigenvectors, Diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices
- Determining and describing the nth term of arithmetic and geometric sequences
- Apply differential calculus tools in solving various application problems
- Apply differentiation to solve maxima and minima problems
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables

TEXT BOOKS:

1. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2014.
2. Narayanan S and Manicavachagom Pillay T K, "Calculus", Volume I and II, S Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Dass H K and Er. Rajnish Verma, "Higher Engineering Mathematics", S Chand Private Ltd., 2011.
2. Bali N P and Manish Goyal, "A Text Book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3. Peter V O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7th Edition, 2012.
4. Veerarajan T, "Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

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20PH101	ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Describe the basics of crystal structures and their growth techniques
- Explain the elastic properties of materials
- Analyze heat transfer mechanisms and their applications
- Develop an understanding of quantum mechanical concepts and their applications
- Gain fundamental knowledge of laser action, their production and fiber optics

UNIT I CRYSTAL PHYSICS **9**

Crystalline and Amorphous materials – Crystal systems, Bravais lattices, Miller indices – Interplanar distance – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques – solution, Melt (Bridgman and Czochralski methods)

UNIT II PROPERTIES OF MATTER **9**

Elasticity – Stress–Strain diagram and its uses – Factors affecting elastic modulus – Twisting couple – Torsion pendulum: Theory and Experiment – Bending of beams – Bending moment – Cantilever: Theory and Experiment – Uniform and Non–Uniform bending: Theory and Experiment I–shaped girders and its application.

UNIT III THERMAL PHYSICS **9**

Modes of heat transfer – Thermal capacity – Newton's law of cooling – Rectilinear heat flow – Thermal conductivity – Forbe's and Lee's disc method: Theory and Experiment – Radial flow of heat – Thermal conductivity of rubber tube – Heat conduction through compound media (Series and Parallel) – Solar power – Advantages – Solar water heater.

UNIT IV QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's Law from Planck's theory – de-Broglie wavelength – Properties of Matter waves – Schrodinger's wave equation – Time independent and time dependent wave equations – Physical significance of wave function – Particle in a one dimensional box – Extension to 3D – Degeneracy – Electron Microscope – Scanning Electron Microscope.

UNIT V LASER AND FIBER OPTICS **9**

Lasers: Principles of laser – Population inversion – Einstein's A and B coefficients–derivation – Modes of vibration in CO_2 molecules – CO_2 Laser – Nd–YAG Laser – Basic principles of a homojunction semiconductor Laser – Industrial and Medical applications of Laser – Fiber optics: principle, numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode) – Fiber optic communication system (Block diagram).

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Identify crystal structure types and describe their growth techniques
- Analyze the elastic properties of materials
- Evaluate the thermal properties of materials
- Explain basic quantum mechanical concepts and their applications
- Elucidate the basic concepts of lasers and their applications

TEXT BOOKS:

1. Pandey B K and Chaturvedi S, "Engineering Physics", Cengage Learning India Pvt. Ltd., Delhi, 2018.
2. Malik H K and Singh AK, "Engineering Physics" TMH, New Delhi, 2010.

REFERENCES:

1. Gaur R K and Gupta S L, "Engineering Physics", DhanpatRai Publications, New Delhi, 2014.
2. Marikani A, "Engineering Physics", PHI learning Pvt. Ltd. New Delhi, Second Edition, 2013.
3. Avadhanulu M N, "Engineering Physics", SChand and Company Ltd, New Delhi, First Edition, 2007.
4. Wahab M A, "Solid State Physics", Narosa Publishing House, New Delhi, 2nd Edition, 2005.

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20CY101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Study the characteristics of water & to know the various treatment methods for effective applications
- Understand the concept of electrochemistry and corrosion prevention
- Know the significance and properties of polymers
- Know the fundamentals of phase rule and its applications and to analyse the principle and generation of energy in batteries and fuel cells
- Evaluate types of fuels based on calorific values and to know the significance of solid, liquid and gaseous fuels

UNIT I WATER TECHNOLOGY **9**

Sources of water – Hard and soft water – Boiler feed water-requirements – disadvantages of using hard water in boilers (Scale- Sludge- Caustic Embrittlement - Priming - Foaming) – Estimation of hardness of water by EDTA method – Internal conditioning (Phosphate, Calgon, Colloidal and Carbonate conditioning methods) – External conditioning – Zeolite and demineralization process – desalination and reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION **9**

Electrochemistry – Nernst equation and its Applications – Electrochemical series – Corrosion – Types – Dry and Wet corrosion – Galvanic corrosion – Differential aeration corrosion – Pitting corrosion – Corrosion control – sacrificial anodic method and impressed current cathodic protection method – Protective coatings – Paints and its constituents.

UNIT III POLYMERS **9**

Polymers – definition – Classification – addition – condensation polymerization and copolymerization – mechanism of polymerization – (cationic, Anionic and free Radical) – Plastics – classification – preparation, properties and uses of PVC, Teflon, Nylon-6,6 and Epoxy resin – Rubber – vulcanization of rubber – butyl rubber, Styrene Butadiene Rubber.

UNIT IV PHASE RULE AND STORAGE DEVICES **9**

Phase Rule – Terms involved – One Component system (water system) – Two component system (Lead-Silver system) – Thermal analysis – Storage devices – Cell and a battery – Alkaline battery – Lead acid battery – Nickel-Cadmium battery and lithium battery – Fuel cells – Hydrogen – Oxygen fuel cell.

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UNIT V FUELS AND COMBUSTION **9**

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 – Theoritical calculation of calorific value – Flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain knowledge on the water quality parameters
- Identify the solutions to prevent corrosion
- Analyse the applications of polymers
- Achieve the knowledge about types of phase diagram and storage devices
- Evaluate the characteristics of various fuels

TEXT BOOKS:

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

REFERENCES:

1. Shika Agarwal, "Engineering Chemistry", Cambridge University Press., Delhi, 2015.
2. Sivasankar B, "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Palanna O G, "Engineering Chemistry" ,Tata Mc.Graw Hill Education Private Limited, New Delhi, 2011
4. Prasanta Rath, "Engineering Chemistry", Cengage Learning India Pvt. Ltd., Delhi, 2018.

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20GE101	STRUCTURED PROGRAMMING USING C (COMMON TO ALL BRANCHES)	L	T	P	C
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OBJECTIVES:

The student should be made to:

- Know the fundamentals of Computer and Programming
- Choose appropriate programming constructs in C language
- Construct programs using array and pointer
- Write programs using string and function
- Develop programs using the concept of structure, union and files

UNIT I FUNDAMENTALS OF COMPUTER AND PROGRAMMING **9**

Computer System - CPU - Memory Unit - Data Representation - Number System and Conversion - Programming Fundamentals - Program Development Life Cycle - Algorithm - Control Structures - Flowchart - Pseudocode - Programming Paradigms - Problem Formulation and Problem Solving.

UNIT II BASICS OF C PROGRAMMING **9**

Overview of C - C Character Set - Identifiers and Keywords - Declaration - Data types - Type Qualifiers and Type Modifiers - Variables and Constants - Structure of a C Program - Executing a C Program - Operators and Expressions - Decision-Making and Looping Statements.

UNIT III ARRAYS AND POINTERS **8**

Introduction to Arrays - Single Dimensional Arrays - Multidimensional Array - Pointers - void Pointer - Null Pointer - Relationship between Arrays and Pointers - Arrays of Pointers - Pointer to a Pointer - Pointer to an Array.

UNIT IV STRINGS AND FUNCTIONS **9**

Strings - Character Arrays - Reading String input - String Library Functions - List of Strings - Command Line Arguments - Functions: Types - Declaration - Definition - Function Call - Pass by Value - Pass by Reference - Passing arrays to functions - Recursion - Pointer to function.

UNIT V STRUCTURE, UNION AND FILES **10**

Structures - Pointers to Structures - Array of Structures - Structures within a Structure - Functions and Structures - typedef and Structures - Unions-Practical Applications of Unions - Enumerations - Bit fields - Storage Classes - C Preprocessor - Files: Streams - File type - File operations - Command line arguments.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand 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
- Write programs using strings and functions
- 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.

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20GE102	ENGINEERING GRAPHICS (COMMON TO ALL BRANCHES)	L T P C 2 0 2 3

OBJECTIVES:

The Student should be made to:

- Explain the students with various concepts like dimensioning, standards, curves and free hand sketching
- Impart knowledge on projection of points, lines and plane surfaces
- Improve the visualization skills for better understanding of projection of solids
- Develop the imaginative skills of the students required to understand section of solids and development of surfaces
- Make the students to understand the viewing perception of a solid object 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 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, epicycloid – 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 – Freehand 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.

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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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **9+6**

Principles of isometric projection – isometric scale – isometric projections of simple solids and truncated 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,

- Apply the concepts of dimensioning, standards, curves and free hand sketching objects
- Sketch the projection of points, straight lines and plane surfaces
- Understand the projection of solids in various positions
- Construct projection of solids and development of surfaces
- Draw isometric and perspective sections of simple solids

TEXT BOOKS:

1. Natarajan K V, "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
2. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International Pvt. Limited, 2015.

REFERENCES:

1. Bhatt N D and Panchal V M, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C M, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K R, "Engineering Drawing", Vol. I and II Combined, Subhas Stores, Bangalore, 2007.

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 appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

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20TA101 **HERITAGE OF TAMILS** **L T P C**
(Common to all branches) **1 0 0 1**

Course Objectives:

Students should be made to

- Evaluate classical language and literature
- Analyze rock art paintings to modern art
- Understand folk and martial arts
- Apply the concept of thinai in Tamils
- Remembering the concept of Tamils to Indian culture

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, Yazh 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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Course Outcomes:

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

- Know the classical language and literature
- Gain knowledge about rock art paintings and modern arts
- Develop folk and martial arts
- Learn concept of Thinai
- Understand our Indian culture

TEXT-CUM-REFERENCE BOOKS

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. பொருநை -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.

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20TA101

தமிழர் மரபு

(அனைத்து துறைகளுக்கும் பொதுவானது)

L T P C
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பாடத்தின் நோக்கங்கள்:

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன

- மொழி மற்றும் இலக்கியங்களை மதிப்பிடுதல்
- பாறை மற்றும் நவீன ஓவியங்களை பகுப்பாய்தல்
- நாட்டுப்புற மற்றும் தற்காப்பு கலைகளை புரிந்து கொள்ளுதல்
- திணையில் தமிழர்களின் கருத்தை பயன்படுத்துதல்
- இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்கினை நினைவு கூறுதல்

அலகு 1 மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விளக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் - பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு 2 மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை –சிற்பக்கலை 3

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

அலகு 3 நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

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

அலகு 4 தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிற பகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

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பாடத்தின் முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன

- மொழி மற்றும் இலக்கியங்களைப் பற்றி அறிந்து கொள்கிறார்கள்
- பாறை மற்றும் நவீன ஓவியங்களை பற்றிய அறிவுகளை கற்கின்றனர்
- நாட்டுப்புற மற்றும் தற்காப்பு கலைகளை வளர்க்க முடிகிறது
- தினைக் கூறும் கருத்துக்களை அறிய முடிகிறது
- நமது இந்திய கலாச்சாரத்தை புரிந்து கொள்ள முடிகிறது

TEXT-CUM-REFERENCE BOOKS

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. பொருநை –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.

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20BS101L	PHYSICS AND CHEMISTRY LABORATORY (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to:

- Understand the characteristics of an engineering material
- Know the physical properties of matter
- Estimate types of ions in drinking water
- Analyze the characteristics of acids
- Know the conductivity of a solution

LIST OF THE EXPERIMENTS - PHYSICS - Any six experiments to be conducted

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method.
9. Determination of Coefficient of Viscosity of liquids by Poiseuille's method.

LIST OF THE EXPERIMENTS - CHEMISTRY – Any seven experiments to be conducted

1. Estimation of HCl using Na_2CO_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. Determination of strength of acids in a mixture of acids using conductivity meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Conductometric titration of strong acid Vs strong base.
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Estimation of iron content of the water sample using spectrophotometer.
10. Determination of rate of corrosion by weight loss method.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Analyze the characteristics of engineering materials.
- Find out the physical properties of matter.
- Assess the water quality parameter.
- Analyze the pH of aqueous solutions.
- Gain knowledge on chemical properties of liquids.

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20GE103L	STRUCTURED PROGRAMMING USING C LABORATORY (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to:

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

PRACTICAL SYLLABUS:

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: 30 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.
- Access data in memory using pointers.
- Use structures and other user defined data structures to manipulate heterogeneous data.
- Manipulate data stored on permanent storage.

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20EEC101L	ENGLISH FOR EFFECTIVE COMMUNICATION (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to:

- Develop and understand verbal and non-verbal communication
- Acquire grammar for effective communication
- Enable learners express different functions using appropriate language
- Enable learners develop their ability to converse in different situations
- Impart skills in using English at workplace effectively

UNIT I UNDERSTANDING COMMUNICATION **6**

Role and Importance of Communication – Verbal and Non-verbal Communication – Barriers to Communication – Communication Mediums – Effective Communication – Group Communication.

UNIT II VOCABULARY AND GRAMMAR **6**

Aspects of vocabulary learning – Word formation – Sentence formation - Short forms of verbs - Common Grammatical Errors – Connective sentences - usage of Idioms and Phrases.

UNIT III EXPRESSING VARIED FUNCTION **6**

Introducing yourself – Greeting – Conversation between stranger – permission – opinion – information – Refusing – Agree/disagree – Apology – Praising – Requesting.

UNIT IV CONVERSATION LANGUAGE **6**

Understanding conversation – Chunking –Telling a story – Understanding public speech – Recognize Instructions – Persuasive Speech –Introduction to emphatic stress – Intensifying important words – Emphasizing corrections.

UNIT V CORPORATE COMMUNICATION **6**

Listening to Videos – Telephone and Email Etiquette – Extempore – Drafting and Delivering a Speech – Making Presentations – Group Discussion.

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Create a group and discuss efficiently in a group communication
- Understand the Sentence formation with proper Vocabulary
- Sort out the language functions to foster a good conversation
- Get the proper pronunciation and usage of language
- Build Communication at workplace in various situations

REFERENCES:

1. Hancock Mark, "English Pronunciation in Use: Intermediate", Cambridge University Press, New Delhi, 2009.
2. Cheepen Christine and James Monaghan, "Spoken English: A Practical Guide", London: Pinter, 1990.
3. Sasikumar V and Dhamija P V, "Spoken English-A Self-Learning Guide to Conversation Practice", TMH, 1995.
4. Singh Ashish, "How to Communicate Effectively", Patridge, New Delhi, 2014.
5. Wilkinson Andrew M, "Spoken English", Edgbaston: University of Birmingham, 1966.

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20EN201	TECHNICAL ENGLISH II (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Improve the reading skills for the purpose of effective communication.
- Make learners acquire listening and speaking skills in both formal and informal contexts.
- Enable learners improve their reading skills from online sources.
- Equip the learners with writing skills needed for academic as well as work place.
- Help the learners improve language skills at their own pace by using the language lab.

UNIT I CONVERSATION **9**

Listening: Barriers to Effective 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: Homonyms-Homophones.

UNIT II INFORMAL USE OF LANGUAGE **9**

Listening: Listening to Situation based Dialogues, Speaking: Using dictionary for learning pronunciation, stress, and syllable divisions. Reading: Reading a short story for appreciation and understanding, Writing: Informal Letter writing – Dialogue writing Grammar: Definition – Purpose expressions – Relative Pronouns, Vocabulary: Technical Vocabulary – Count/Un count nouns.

UNIT III GENERAL READNING **9**

Listening: Listening strategies for deeper understanding, Speaking: Asking about Routine actions and giving directions, Reading: an article from Newspaper – Critical reading, Writing: Minutes of meeting – Essay writing, Grammar: Degrees of Comparison, Vocabulary: Collocations.

UNIT IV ENGLISH FOR CAREER **9**

Listening: Listening strategies for Effective conversation, Speaking: Group Discussion skills, Reading: pre reading and post reading tasks, Writing: Applying for a Job – Cover Letter – Resume preparation, Grammar: Articles, Vocabulary: Synonyms and Antonyms.

UNIT V REPORT WRITING **9**

Listening: Listening and making notes, Speaking: Discussion on problems and solutions, Reading: Reading Journal Articles, Writing: Types of Reports – (Feasibility/Accident/Project Report), Grammar: If' Clause, Vocabulary: Idioms and their Meanings.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Speak fluently, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings
- Read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation
- Make effective presentations using power point and participate successfully in Group Discussions
- Write efficiently and persuasively and create different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing

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, New Delhi, 2014.
2. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, Inc., 2001.
3. Rizvi M Ashraf, "Effective Technical Communication", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2005.
4. Perumal Lakshmana N and Sathiseelan S, "Technical English-II", Sri Krishna Hitech Publishing Company Pvt.Ltd, Chennai, 2014.

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20MA201	MATHEMATICS-II (COMMON TO ALL BRANCHES)	L T P C 3 1 0 4

OBJECTIVES:

The student should be made to:

- Make the student acquire sound knowledge of techniques in solving ordinary differential equations obtained from engineering problems
- Acquaint the student with the concepts of vector calculus that is needed for problems in engineering disciplines
- Understand the Analytic Functions can be widely used for modelling the various laws of physics
- Familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- Make the student for appreciating the purpose of using transforms to create a new domain in which it is earlier to handle the problem that is being investigated

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

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

UNIT II VECTOR CALCULUS 12

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration: line integral – surface integral – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs)

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping $(w = z^2, z + k, 1/z, kz)$ and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

UNIT V LAPLACE TRANSFORM 12

Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and final value theorems – Transform of periodic functions – Inverse transforms – Convolution theorem – Solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Apply various methods of solving differential equation which arise in many application problems
- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals
- Examine analytic functions and its properties, conformal mapping and its applications
- Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem
- Use knowledge of Laplace transform and its properties, inverse Laplace transform to solve linear differential equations

TEXT BOOKS:

1. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2014.
2. Bali N P and Manish Goyal, "A Text Book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.

REFERENCES:

1. Dass H K and Er. Rajnish Verma, "Higher Engineering Mathematics", S Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2012.
3. Jain R K and Iyengar S R K, "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4. Veerarajan T, "Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

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20BS201	ENVIRONMENTAL SCIENCE (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Study the interrelationship between living organism and environment
- Understand and tackle the impacts of pollution.
- Attain sustainable development by conserving natural resources.
- Find and implement scientific, technological, economic and political solutions to environmental problems
- Analyze the problems faced by the over population.

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 – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Endangered, Extinct and Endemic species – conservation of biodiversity: In-situ and ex-situ methods.

UNIT II ENVIRONMENTAL POLLUTION 9

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

UNIT III NATURAL RESOURCES 9

Forest resources: deforestation – mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water – dams-benefits and problems – Mineral resources: environmental effects of extracting and using mineral resources – Food resources: World food problems – Effects of modern agriculture – fertilizer-pesticide problems, water logging, salinity – Energy resources: renewable and non-renewable energy sources (Solar, wind, Coal, Petrol, Nuclear) Land resource: land degradation, Soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Sustainable development – Water conservation – rain water harvesting – resettlement and rehabilitation of people; its problems and concerns – environmental ethics – global warming – acid rain , ozone layer depletion – wasteland reclamation – consumerism – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Role of NGO's in environmental protection.

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UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge on public awareness & about the environment & ecosystem.
- Able to identify the impacts of pollution.
- Frame solutions to achieve sustainable development.
- Able to analyze about the social issues in the environment.
- Apply the acquired knowledge to tackle the problems of over population.

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.

REFERENCES:

1. Tyler Miller G and Scott Spoolman, "Introduction to Environmental Science", Cengage Learning India Pvt., Ltd., 2009.
2. Dharmendra S Sengar, "Environmental Law", Prentice hall of India Pvt Ltd, New Delhi, 2007.

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20BE202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO AGE AND CIVIL)	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- Explain the basic knowledge about laws used in electrical circuits
- Understand the modeling and operation of electrical machines
- Learn the principles and operation of measuring instruments and transducers
- Introduce the basic concepts of semiconductor devices
- Impart knowledge of various communication systems

UNIT I FUNDAMENTALS OF ELECTRICITY AND DC CIRCUITS 9

Introduction – Definition, symbol and unit of quantities –Ohm's law - Network terminology - Kirchhoff's law - Resistance in series and voltage division technique - Resistance in parallel and current division technique - Loop analysis - Nodal analysis – Star to delta and delta to star transformation.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Principle, construction, EMF equation, types - Characteristics of DC motor.
AC Machines: Construction and working principle of transformer - Construction, working of three phase induction motor - Construction and types of single phase induction motors.

UNIT III ELECTRICAL MEASUREMENTS 9

Classification of instruments – Basic principle of indicating instruments – Moving iron instruments - Moving coil instruments – Energy meter - Watt meter – Classification of transducer, Capacitive and inductive transducer – LVDT - Hall effect -Piezoelectric transducer.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Introduction to semiconductors -PN junction diode, Zenerdiode and its characteristics – Half wave and full wave rectifiers. Bipolar Junction Transistor – CB, CE, CC configurations and characteristics. Power conditioning equipments: Linear mode power supply, SMPS and UPS. Display devices: LED and LCD.

UNIT V COMMUNICATION SYSTEMS 9

Introduction – Communication systems – Analog and digital signals. Basic principles of modulation: Amplitude Modulation, Frequency Modulation. Communication systems: Microwave Communication – Satellite Communication – Optical fibre communication – ISDN(Block diagram approach only).

TOTAL: 45 PERIODS

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BoS (AGE)

OUTCOMES:

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

- Understand the fundamentals of electric circuits
- Explain the basic operation and performance of electrical machines
- Illustrate the working of measuring equipment and transducers
- Develop an electronic circuits using semiconductor devices
- Analyze the various communication systems.

TEXT BOOK:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical Electronics and Computer Science Engineering", 3rd reprint, The McGraw Hill, 2009.

REFERENCES:

1. Theraja B L, "Fundamentals of Electrical Engineering and Electronics", Chand & Co, 2008.
2. Sukhija M S and Nagsarkar T K, "Basic Electrical and Electronic Engineering", , Oxford, 3rd Edition, 2017.
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 7th Edition, 2014.

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BoS (EEE)

CHAIRMAN
BoS (AGE)

20AG201 PRINCIPLES AND PRACTICES OF CROP PRODUCTION **L T P C**
3 0 0 3

OBJECTIVES:

The students should be made to:

- Introduce the principles of agriculture and crop production
- Acquire knowledge on how to select a crop and its establishment
- Understand the application of crop protection techniques for better crop production
- Impart knowledge on production practices of agricultural crops
- Explain the production practices of horticultural 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 – Field preparation for crops including systems of tillage – 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 – Crop protection including management of weeds, pests and pathogens – Integrated methods of managing water, nutrients and plant protection – Types and methods of harvest.

UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS **9**

Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, fiber crops and special purpose crops such as those grown for green manure and fodder.

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS **9**

Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops – Cultivation practices of representatives of each group – Special features of production of horticultural crops – green house cultivation.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the basics of agriculture and crop production
- Identify and select suitable crops for adequate production
- Acquire knowledge on water, nutrient and crop protection
- Illustrate the production of food, feed and fiber crops
- Describe the horticultural crop production and green house cultivation

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.

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., 2nd Edition, 2018.
3. Kumar N, "Introduction to Horticulture", Medtech Publications, 8th Edition, 2018.

V. Gopal

CHAIRMAN
BoS (AGE)

20AG202 **FLUID MECHANICS AND HYDRAULICS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Familiarize with the properties of fluids and behavior of fluids
- Introduce the importance of various types of flow measurement
- Formulate and analyze problems related to dimensional analysis and turbine
- Understand various hydraulic engineering problems in open channel flows
- Create an exposure in various types of pumps

UNIT I PROPERTIES OF FLUIDS **9**

Properties of fluids – definition – units of measurement. Fluid pressure and measurement – simple, differential and micro manometers – Mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure – Horizontal – vertical and inclined plane surface – Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancy – meta centre – metacentric height.

UNIT II FLOW MEASUREMENT **9**

Bernoulli's equation – applications – Venturimeter – orifice meter – nozzle meter – rotameter – elbow meter – pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece – Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – Reynold's experiment - Darcy – Weisbach equation – Chezy's formula – Manning's formula – Hazen - William"s formula – Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves.

UNIT III DIMENSIONAL ANALYSIS AND TURBINES **9**

Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh's method and Buckingham Pi-Theorem – concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers. Pelton wheel, Francis and Kaplan turbines – working principles – workdone by water on the runner – draft tube – performance curves for turbines – governing of turbines.

UNIT IV OPEN CHANNEL FLOW **9**

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth – momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method – Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

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UNIT V PUMPS **9**

Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers – Priming – cavitation – specific speed – characteristic curves. Submersible pumps – Jet pump – jet assembly – Other pumps – Air lift pump – reciprocating pump – sludge pump and vacuum pump – Hydraulic ram.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the fundamentals of fluid properties and characteristics of a fluid
- Analyze and calculate major and minor losses associated with flow through pipes
- Predict the nature of fluid physical quantities and analyze the performance of turbines
- Apply the applicability of physical laws in open channel flow
- Evaluate the performance of pumps

TEXT BOOKS:

1. Bansal R K, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 10th Edition, 2018.
2. Modi P N and Seth S M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 21st Edition, 2018.

REFERENCES:

1. Graebel W P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.
2. Kumar K L, "Engineering Fluid Mechanics", S.Chand & Co. Ltd, Reprint Edition, 2006
3. Robert W Fox, Alan T McDonald and Philip J Pritchard, "Fluid Mechanics and Machinery", John Wiley and Sons, 9th Edition, 2015.
4. Streeter V L and Wylie E B, "Fluid Mechanics", McGraw Hill Publishing Co., 9th Edition, 2017.

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20TA201

TAMILS AND TECHNOLOGY
(Common to all branches)

L T P C
1 0 0 1

Course 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

Course Outcomes:

At the end of the Course, 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. 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. பொருநை –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.

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20TA201

தமிழரும் தொழில்நுட்பமும்
(அனைத்து துறைகளுக்கும் பொதுவானது)

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பாடத்தின் நோக்கம்

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்
- வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்
- உற்பத்தி தொழில்நுட்பத்தை பகுப்பாய்வு செய்தல்
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத்தைப் பயன்படுத்துதல்
- அறிவியல் மற்றும் அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறியை நினைவுபடுத்துதல்

அலகு 1 நெசவு மற்றும் பானை தொழில் நுட்பம் 3

சங்க காலத்தில் நெசவுத்தொழில் – பானை 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 – மாமல்லபுரச் 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.

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

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பாடத்தின் முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன

- பீங்கான் மற்றும் நெசவு தொழில்நுட்பத்தை புரிந்துகொள்வது
- புதிய வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்
- உற்பத்தித் தொழில்நுட்பத்தை அடையாளம் காணுதல்
- விவசாயம் மற்றும் நீர்ப்பாசனம் பற்றிய புரிதல்
- அறிவியல் தமிழ் மற்றும் தமிழ் கணினி பற்றிய அறிவு

TEXT-CUM-REFERENCE BOOKS

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)
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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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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.

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20GE201L	ENGINEERING PRACTICES LABORATORY (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to:

- Access the areas of knowledge in application criteria's for plumbing, carpentry through practical manner
- Develop the engineering basis work in welding, machining and sheet metal works
- Make the specified skills in foundry, smithy and fitting operations
- Study the various basic domestic wiring circuits and measure the electrical parameters
- Impart the knowledge of basic electronic components and assemble simple electronic circuits in printed circuit boards

GROUP A (CIVIL AND MECHANICAL)

I. CIVIL ENGINEERING PRACTICE **5**

1. Buildings
   (a) Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.
2. Plumbing Works
   (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
   (b) Study of pipe connections requirements for pumps and turbines.
   (c) Preparation of plumbing line sketches for water supply and sewage works.
   (d) Hands-on-exercise:
      (i) Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
      (ii) Demonstration of plumbing requirements of high-rise buildings.
3. Carpentry using Power Tools only
   (a) Study of the joints in roofs, doors, windows and furniture.
   (b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

II. MECHANICAL ENGINEERING PRACTICE **10**

1. Welding:
   (a) Arc Welding
      (i) Butt joints.
      (ii) Lap joints.
      (iii) T-joints.
   (b) Gas welding practice.
2. Basic Machining
   (a) Simple Turning, Facing.
   (b) Drilling Practice.
3. Sheet Metal Work
   (a) Model making-Cylinder, Funnel and Tray.
   (b) Different type of joints.

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4. Machine assembly practice:
   (a) Study of Centrifugal pump
   (b) Study of Air conditioner
5. Demonstration on:
   (a) Smithy operations, upsetting, swaging, setting down and bending.
   Example: Exercise – Production of hexagonal headed bolt.
   (b) Foundry operations like mould preparation for gear and step cone pulley.
   (c) Fitting – Exercises – Preparation of square fitting and V-fitting models.

GROUP B (ELECTRICAL AND ELECTRONICS)

III. ELECTRICAL ENGINEERING PRACTICE **10**

1. a) Residential house wiring using switches, fuse, indicator, lamp and Energy meter.
   b) Study of different type of electrical wiring joints systems.
   c) Stair case wiring.
2. Industrial wiring using switches, fuse, indicator and Energy meter.
3. Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit.
4. Measurement of energy using single phase energy meter.
5. Measurement of earth resistance using Megger.
6. Assembling of ceiling fan.

IV. ELECTRONICS ENGINEERING PRACTICE **5**

1. Study of Electronic components and equipments – Resistor colour coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Study of logic gates AND, OR, NOT, NAND and NOR.
3. Soldering practice - Components Devices and Circuits - Using general purpose PCB.
4. Design of HWR and FWR.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Apply the tasks of work in plumbing and carpentry in application areas regard to pipeline joints, household fittings, water supply and sewage works, joints in roofs, doors, windows and furniture
- Analyze the engineering knowledge through welding, sheet metal forming, bending and basic machining operations
- Understand the assembly works on study of pump, Air conditioner and demonstration works on Smithy, foundry and fitting operation
- Understand the basic domestic wiring circuits and measure the various electrical parameters
- Analyse the basic concept of digital circuits and assemble electronic circuits

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20AG203L	CROP HUSBANDRY FIELD LABORATORY	L	T	P	C
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OBJECTIVES:

The student should be made to:

- Acquire knowledge on field preparation, seed selection and seed treatment
- Introduce the seed bed and management of crops
- Understand the principle of nutrient management
- Impart the knowledge on water management and irrigation scheduling
- Illustrate the harvesting tools and their techniques

LIST OF EXPERIMENTS:

1. Field preparation studies
2. Seed selection and seed treatment procedures
3. Seed bed and nursery preparation
4. Sowing / Transplanting
5. Biometric observation for crops
6. Nutrient management studies
7. Water management and irrigation scheduling
8. Weed management studies
9. Integrated Pest Management studies
10. Harvesting
11. Post harvesting

TOTAL: 30 PERIODS

OUTCOMES:

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

- Able to prepare field for cultivation and seed treatment
- Acquire adequate knowledge on crop management
- Explain the fundamentals of nutrient management for crops
- Hands on experience on water management and irrigation scheduling
- Select suitable harvesting techniques

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BoS (AGE)

20ME406L	FLUID MECHANICS AND MACHINERY LABORATORY (COMMON TO MECH AND AGE)	L T P C 0 0 2 1

OBJECTIVES:

The Student should be made to:

- Understand the flow measurements using different devices
- Determine the experimental data related to different losses in pipes
- Study about the working principle of pumps and turbines
- Determine the experimental data and performance characteristic of pumps
- Determine the experimental data and performance characteristic of turbines

LIST OF EXPERIMENTS:

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Determine the flow rate of fluid using different devices
- Calculate the loss of head due to friction for the different pipe setup
- Obtain knowledge about the working principle of pumps and turbines
- Compute the efficiency and performance characteristic curves of pumps
- Compute the efficiency and performance characteristic curves of turbines for different load condition

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20EEC201L	SOFT SKILLS (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to:

- Develop in learners a deep sense of self- esteem
- Enhance learners' self-motivation
- Impart leadership skills
- Help learners enhance critical, creative and analytical skills
- Felicitate learners acquire problem solving skills

UNIT I IDENTITY CONSTRUCTION **6**

Identity formation – Theories of moral Development(Kohlberg) – Cultural heritage – Physical appearance – Problem of Identity Correspondence –Self acceptance– Knowing oneself – Self-confidence –Positive thinking – Self-development – Perception, attitude and Behavioural change, Personality development – Self-esteem.

UNIT II MOTIVATION AND MORALE **6**

Definition – types (Intrinsic and Extrinsic) – Theories (Maslow's hierarchical needs) – Factors that affect motivation – Motivational strategies – Motivational plan – Interruption and Distractions – Motivation in the Business World.

UNIT III PROFESSIONAL THEORIES **6**

Communication – Functions of leadership – Work pressure handling – Creative and critical thinking – Career planning and management – Emotional intelligence – Time management – Negotiation – Conflict management

UNIT IV APPLICATION SKILLS **6**

Visionary thinking – formulating strategies – shaping strategies – building organizations relationships – change management – Project Management Skills – Independent working skills - Writing skills – Public Speaking –Analytical skills – Neo Research and Development.

UNIT V PROBLEM SOLVING SKILLS **6**

Problem solving approaches and its components – Teamwork – Innovative and creative thinking– Tools and Techniques – Application of SMART analysis – Adaptability and flexibility– Decision making.

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Know the detail information of individuals
- Increase the self-confidence and develop the moral identity
- Accumulate the learner's career building skills
- Improve professional and life skills
- Engage the imagination to explore new possibilities, Formulate and articulate ideas.

REFERENCES:

1. Covey Sean, "Seven Habits of Highly Effective Teens", New York, Fireside Publishers, 1998.
2. Thomas A Harris, "I am Ok, You Are Ok", Harper and Row,New York, 1972.
3. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.

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20MA302 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
(COMMON TO AGE, BME, CIVIL, ECE, EEE AND MECH) 3 1 0 4

OBJECTIVES:

The student should be made to:

- Introduce the basic concepts of PDE for solving standard partial differential equations.
- Introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- Acquaint Fourier series techniques in solving heat flow problems used in various situations.
- Acquaint Fourier transform techniques used in wide variety of situations.
- Introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables – Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Understand how to solve the given standard partial differential equations
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems

TEXT BOOKS:

1. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Narayanan S, Manicavachagom Pillay T K and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, S Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES:

1. Bali N P and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt. Ltd, 9th Edition, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley, India, 10th Edition, 2016.
3. James G, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2007.
4. Ramana B V, "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5. Wylie R C and Barrett L C, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, New Delhi, 6th Edition, 2012.

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20AG301	THERMODYNAMICS AND HEAT TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be made to:

- Understand the basic concepts and first law of thermodynamics
- Analyze the second law with its statements and concept of entropy
- Gain knowledge on the mechanisms of heat transfer under steady, transient conditions and fins
- Analyze the free and forced convective heat transfer in external and internal flows
- Explore the phenomena of radiation and heat exchangers

(Use of standard HMT data book permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

Basic concepts – concept of continuum, micro, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path, process and quasi-static process. Work – modes of work. Zeroth law of thermodynamics First law of thermodynamics – application of closed and open systems. Steady flow energy equation for various thermal equipments.

UNIT II SECOND LAW AND ENTROPY 9

Second law of thermodynamics – Kelvin-Planck and Clausius statements of second law. Carnot cycle, Reversed Carnot cycle, Carnot's theorem – Heat engine – efficiency – Refrigerator, Heat pump – COP. Inequality of Clausius - Concept of entropy, principle of increase in entropy, absolute entropy.

UNIT III CONDUCTION 9

General Differential equation of Heat Conduction – Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction – plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids – Use of Heisler's charts.

UNIT IV CONVECTION 9

Free and Forced Convection – Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates, Cylinders and Internal flow through tubes.

UNIT V RADIATION AND HEAT EXCHANGERS 9

Black Body Radiation – Grey body radiation – Radiation Shields. Heat Exchanger – Types – Overall Heat Transfer Coefficient – Fouling Factors – Analysis – LMTD method – NTU method.

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OUTCOMES:

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

- Gain the capability of problem solving in thermodynamic processes
- Acquire the knowledge on second law of thermodynamics and entropy concept
- Understand the concepts of conduction heat transfer and extended surfaces
- Apply the phenomenon of free and forced convective heat transfer in external and internal flows
- Evaluate the radiation emissivity and sizing of heat exchangers

TEXT BOOKS:

1. Nag P K, "Engineering Thermodynamics", Tata McGraw Hill Publishing Company, New Delhi, 6th Edition, 2017.
2. Holman J P, "Heat Transfer", McGraw-Hill Education - Europe, 10th Edition, 2017.

REFERENCE BOOKS:

1. Rajput R K, "Engineering Thermodynamics", Laxmi Publications, New Delhi, 5th Edition, 2016.
2. Arora C P, "Thermodynamics", Tata McGraw Hill Publishing Company, New Delhi, 2017.
3. Kothandaraman C P, "Fundamentals of Heat and Mass Transfer", New Age International Pvt. Ltd, New Delhi, 4th Edition, 2012.
4. Yunus A Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill Publishing Company, New Delhi, 5th Edition 2012.

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20AG302 STRENGTH OF MATERIALS AND ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Gain knowledge of simple stresses, strains and deformation in components due to external loads
- Study the concept of shearing force and bending moment due to external loads in beams and their effect on stresses
- Compute slopes and deflections in beams by various methods
- Understand the basic concepts of forces and friction
- Impart analytical skills to solve problems related to centroid and moment of area

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM **9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III DEFLECTION OF BEAMS **9**

Computation of slopes and deflections in determinate beams – Double Integration method – Macaulay"s method – Area moment method – Conjugate beam method.

UNIT IV STATICS OF PARTICLES AND FRICTION **9**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Coplanar Forces – rectangular components – Equilibrium of a particle – Principle of transmissibility. Frictional force – Laws of coulomb friction – Simple contact friction – Rolling resistance – Belt friction and ladder friction.

UNIT V PROPERTIES OF SURFACES **9**

Centroid – First moment of area and second moments of plane area of sections – Rectangle, circle, triangle from integration – T section and I section – Parallel axis theorem and perpendicular axis theorem.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Estimate the stress, strain and strain energy relations for simple and compound bars
- Plot the shear force and bending moment diagrams and analyze the bending stresses in beams
- Estimate the slope and the deflection of beams
- Determine the resultant force and various frictional forces applying laws of friction
- Analyze various properties of surfaces

TEXT BOOKS:

1. Bansal R K, "Strength of Materials", Laxmi Publications, New Delhi, 6th Edition, 2019.
2. Hibbeller R C, "Engineering Mechanics & Dynamics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd, 14th Edition, 2016.

REFERENCES:

1. Rajput R K, "Strength of Materials", S Chand & Company Pvt. Ltd, New Delhi, 7th Edition, 2018.
2. Khurmi R S and Khurmi N, "Strength of Materials", S Chand & Company Pvt. Ltd, New Delhi, 26th Edition, 2019.
3. Vela Murali, "Engineering Mechanics", Oxford University Press, New Delhi, 2016.
4. Palanichamy M S and Nagam S, "Engineering Mechanics - Statics & Dynamics", McGraw Hill Education India Pvt. Ltd, New Delhi, 3rd Edition, 2006.

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20CE303	SURVEYING (COMMON TO CIVIL AND AGE)	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- Evaluate linear and angular measurements using chain and compass.
- Understand the applications of theodolite survey in angular measurements.
- Gain knowledge on various concepts of control surveying and its adjustments.
- Demonstrate the basic concepts of astronomical surveying.
- Develop skills to operate different types of advanced surveying techniques by learning its working principles.

UNIT I INTRODUCTION OF SURVEYING **9**

Definition - Principles - Classification - Scales - Survey instruments, their care and adjustment - Ranging and chaining - Reciprocal ranging - Prismatic compass - Bearing - Systems and conversions - Local attraction - True and magnetic meridians - Magnetic declination - Dip - Traversing - Level line - Horizontal line - Spirit level - Temporary and permanent adjustments - Fly and check leveling.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING **9**

Theodolite - Description and uses - Temporary and permanent adjustments - Horizontal - Vertical angles - Heights and distances - Traversing - Closing error and distribution - Gale's table - Tacheometry - Principle - Systems - Tangential - Stadia methods - Horizontal and inclined sights - Staff - Vertical and normal - Fixed and movable hairs - Stadia constants - Analytic lens - Contour.

UNIT III CONTROL SURVEYING AND ADJUSTMENTS **9**

Triangulation - Classification - Signals and towers - Baseline measurement - Instruments and accessories - Tape corrections - Extension of baseline - Satellite stations - Reduction to centre - Trigonometrical leveling - Classification - True and most probable values - Laws of weights - Weighted observations - Principle of least squares - Normal equation and method of correlates.

UNIT IV ASTRONOMICAL SURVEYING **9**

Celestial sphere - Astronomical terms and definitions - Motion of sun and stars - Apparent altitude and corrections - Celestial co-ordinate systems - Spherical trigonometry - Latitude and longitude of a place - Field observations and calculations for azimuth - Nautical almanac.

UNIT V ADVANCED SURVEYING TECHNIQUES **9**

Total Station - Advantages - Fundamental quantities measured - Parts and accessories - Working principle - On board calculations - Field procedure - Errors and good practices in using total station GPS surveying - Different segments - Space, control and user segments - Orbit determination and representation - Anti spoofing and selective availability - Hand held and geodetic receivers - Data processing - Remote sensing application.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Demonstrate various surveying instruments to calculate linear and angular measurements.
- Measure horizontal angles and vertical angles using theodolite and tacheometric instruments.
- Understand different methods of levelling.
- Evaluate astronomical surveying and methods to determine time, longitude, latitude and azimuth.
- Develop knowledge on concepts and principles of modern surveying.

TEXT BOOKS:

1. Punmia B C, Ashok K Jain and Arun K Jain, "Surveying Vol. I & II", Lakshmi Publications Pvt. Ltd., 16th Edition, New Delhi, 2011.
2. Kanetkar T P and Kulkarni S V, "Surveying and Levelling", Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

REFERENCE BOOKS:

1. Arora K R., "Surveying Vol I & II", Standard Book house, 17th Edition, 2019.
2. Satheesh Gopi, Sathishkumar R and Madhu N, "Advanced Surveying, Total Station GPS and Remote sensing", Pearson Education, 2007.

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20EC308	ELECTRONICS AND MICROPROCESSORS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be made to:

- Learn the fundamental concepts of Semi Conductors and rectifiers
- Understand the characteristics of transistors and amplifiers
- Know the basic concepts of logic gates and combinational circuits
- Impart the knowledge of 8085 microprocessor
- Study the interfacing techniques of 8085 microprocessor

UNIT I SEMICONDUCTORS AND RECTIFIERS **9**

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - PN junction - Zener effect - Zener diode characteristics-Half wave and full wave rectifiers -Voltage regulation

UNIT II TRANSISTORS AND AMPLIFIERS **9**

Bipolar junction transistor - CB, CE, CC configuration and characteristics-Biasing circuits - Class A, and C amplifiers - Field effect transistor - Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications - Switching transistors-Concept of feedback – Negative feedback - Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS **9**

Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra – Exclusive OR gate - Flip flops -Half and full adders – Registers - Counters - A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR **9**

Block diagram of microcomputer - Architecture of 8085 - Pin configuration - Instruction set Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR **9**

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Know the fundamentals of semiconductor devices performance
- Incorporate transistor concepts into their electronic designs
- Apply the digital fundamentals in future designs
- Comprehend the basic requirements and layout of microprocessor
- Solve the real world control problems as applications

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TEXT BOOKS:

1. Milman J and Halkias, "Integrated Electronics", Tata McGraw-Hill Publishers, New Delhi, 2nd Edition, 2010.
2. Ramesh S Goankar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing, New Delhi, 4th Edition, 2000.

REFERENCES:

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill Publishers, New Delhi, 7th Editon, 2011.
2. Mehta V K and Rohit Mehta, "Principles of Electronics", S. Chand and Company Ltd, New Delhi, 11th Edition, 2014.
3. Dougles V Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata Mc Graw- Hill Publishers, New Delhi, 2nd Edition, 1999.
4. Salivahanan S, Suresh Kumar N and Vallavaraj A, "Electronic Devices and Circuits" Tata McGraw-Hill Publishers, New Delhi, 1st Edition, 1999.

LIST OF EXPERIMENTS ELECTRONICS

1. VI Characteristics of PN Junction Diode & Zener Diode
2. Characteristics of JFET
3. Characteristics of CE Transistor
4. Characteristics of Uni Junction Transistor
5. Study of Logic Gates (Basic Gates)
6. Half Adder and Full Adder
7. Registers & Counters

LIST OF EXPERIMENTS MICROPROCESSORS

1. 8 bit Addition, Subtraction
2. Multiplication and Division
3. Sorting
4. Stepper Motor Interfacing

TOTAL: 30 PERIODS

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20MC002	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

Objectives

The students should be made to:

- Understand the need of value education and human aspiration
- Know the difference between self and body
- Recognize the harmony in the family and society
- Understand harmony in nature
- Identify the human values and ethics

UNIT I INTRODUCTION TO VALUE EDUCATION **9**

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

UNIT II HARMONY IN THE HUMAN BEING **9**

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 **9**

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 **9**

Nature - as Collections of Units, Classification of Units into Four Orders, Interconnectedness, and mutual fulfillment 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 **9**

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: 45 PERIODS

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Outcome:

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

- Understand the significance of value education and distinguish between values and skills.
- Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
- Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings.
- Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
- Distinguish between ethical and unethical practices and understand the human values.

Text Books:

1. Gaur R R, Sangal R and Bagaria G R, 2009, "A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd 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, 12th 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.

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20CE406L	STRENGTH OF MATERIALS LABORATORY (COMMON TO CIVIL AND AGE)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The students should be made to:

- Understand the stress strain behavior of mild steel rod
- Obtain the hardness value of various metals
- Analyze the deflection acting on springs by applying tensile and compressive load
- Determine impact strength of mild steel
- Evaluate the properties of wood by conducting compression test

LIST OF EXPERIMENTS:

1. Tension test on mild steel rod.
2. Torsion test on mild steel rod.
3. Compression test on wood.
4. Tests on open coiled helical springs.
5. Tests on close coiled helical springs.
6. Izod and charpy impact tests.
7. Determination of rockwell and brinell hardness number.
8. Static bending test on metal beam.
9. Yield strength, ultimate strength, percentage of elongation and young's modulus for the mild steel rod and HYSD bars using UTM.
10. Maximum shear strength of the mild steel and aluminium bar using double shear test.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Illustrate the behaviour of mild steel under the action of tensile and compressive load
- Calculate the hardness value of the various metal specimens
- Determine the torsional and impact strength of mild steel
- Understand the properties of wood when the load is acting parallel to grain
- Evaluate the stiffness and deflection of open coiled, close coiled springs

REFERENCES:

1. "Strength of Materials Laboratory Manual", Anna University, Chennai-600 025.
2. IS1786-2008, "High Strength Deformed Bars and Wires for Concrete Reinforcement – Specification", 2008.

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20CE306L	SURVEYING LABORATORY (COMMON TO CIVIL AND AGE)	L T P C 0 0 2 1

OBJECTIVES:

The students should be made to:

- Impart knowledge on measuring area and offset by using chain surveying
- Evaluate concepts of bearing and area measurements using different compass
- Develop training on different methods of plane table surveying
- Acquire knowledge to calculate reduced levels using different methods of levelling
- Determine the elevation between two inaccessible points using total station

LIST OF EXPERIMENTS

1. Study of chains and its accessories, aligning, ranging, chaining and marking perpendicular offset.
2. Setting out works – Foundation marking using tapes single room and double room.
3. Compass traversing – Measuring bearings and arriving included angles.
4. Fly levelling using dumpy level and tilting level.
5. Check levelling.
6. Measurements of horizontal angles by reiteration and repetition and vertical angles.
7. Determination of elevation of an object using single plane method when base is accessible /inaccessible.
8. Determination of tacheometric Constants.
9. Location of points by resection method – Three point problem.
10. Plotting of contours.
11. Traverse using total station and area of traverse.
12. Determination of distance and difference in elevation between two inaccessible points using total station.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Demonstrate conventional surveying instruments such as chain/tape, compass, plane table and theodolite
- Evaluate levelling using various instruments and to plot contour
- Measure horizontal and vertical angles by reiteration and repetition method
- Determine tacheometric constants
- Calculate the distance and elevation between two accessible and inaccessible points

REFERENCES:

1. Punmia BC, Ashok K Jain and Arun K Jain, "Surveying" Vol. I and II, Lakshmi Publications, Pvt Ltd, New Delhi, 2005.
2. Venkatramaiah, "Text Book of Surveying", University Press, New Delhi, 2014.

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20EEC301L	SOFT SKILLS DEVELOPMENT (COMMON TO ALL BRANCHES)	L T P C 0 0 2 1

OBJECTIVES:

The Student 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 behavior 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

Basic Concepts – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M-Commerce - Structure – Pros and Cons – Mobile Payment System – Security Issues.

TOTAL: 30 PERIODS

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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

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 and Schuster, 1998.
3. Jeff Butterfield, "Soft Skills for Everyone", Cengage Learning, 2011.

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20MA404	PROBABILITY AND STATISTICS (COMMON TO AGE, BME AND IT)	L T P C 3 1 0 4

OBJECTIVES:

The student should be made to:

- Introduce the basic concepts of probability and random variables
- Introduce the basic concepts of two dimensional random variables
- Acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- Introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control
- Apply the statistical tools in engineering problems

UNIT I RANDOM VARIABLES **12**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES **12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS **12**

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means – Tests based on t, Chi-square and F distributions for mean, variance and proportion – Contingency table (test for independent) – Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS **12**

One way and two way classifications – Completely randomized design – Randomized block design – 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL **12**

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

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications
- Apply the concept of testing of hypothesis for small and large samples in real life problems
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems

TEXT BOOKS:

1. Gupta S C and Kapoor V K, "Fundamental of Mathematical Statistics", S Chand Publications, Reprint, 2013.
2. Richard A Johnson, "Probability and Statistics for Engineers", Pearson Education, 8th Edition, 2011.

REFERENCES:

1. Devore J L, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis A and Unnikrishnapillai S, "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, New Delhi, 4th Edition, 2010.
3. Ross S M, "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, 3rd Edition, 2004.
4. Veerarajan T, "Probability, Statistics and Random with Queueing Theory and Queueing Networks", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2010.
5. Moorthy M B K, "Probability and Statistics", Scitech Publications India Pvt Ltd., 2011.

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20AG401 UNIT OPERATIONS IN AGRICULTURAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Acquire basic knowledge in engineering process like evaporation and concentration
- Understand the different mechanical separation involved in agricultural processing
- Introduce the basic concept involved in various size reduction equipments for agricultural processing
- Impart knowledge on the concepts of separation, absorption and extraction process
- Gain knowledge on the principles of Crystallization and Distillation in processing of agricultural produce

UNIT I EVAPORATION AND CONCENTRATION 9

Unit operations in food processing – conservation of mass and energy – overall view of an engineering process – dimensions and units – dimensional and unit consistency – dimensionless ratios – evaporation – definition – liquid characteristics – single and multiple effect evaporation performance of evaporators and boiling point elevation – capacity – economy and heat balance types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator.

UNIT II MECHANICAL SEPARATION 9

Filtration – definition – filter media – types and requirements – constant rate filtration – constant pressure filtration – filter cake resistance – filtration equipment – rotary vacuum filter – filter press sedimentation – gravitational sedimentation of particles in a fluid – Stoke's law, sedimentation of particles in gas – cyclones – settling under sedimentation and gravitational sedimentation – centrifugal separations – rate of separations – liquid – liquid separation - centrifuge equipment.

UNIT III SIZE REDUCTION 9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products – energy and power requirements in comminuting – crushing efficiency – Rittinger's, Bond's and Kick's laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher – crushing rolls – grinders – hammer mills – rolling compression mills – attrition, rod, ball and tube mills – construction and operation.

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UNIT IV CONTACT EQUILIBRIUM SEPARATION 9

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium – equilibrium concentration relationships – operating conditions – calculation of separation in contact – equilibrium processes – gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment – properties of tower packing – types – construction – flow through packed towers – extraction – rate of extraction – stage equilibrium extraction – equipment for leaching coarse solids – intermediate solids – basket extractor – extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers – washing – equipments.

UNIT V CRYSTALLISATION AND DISTILLATION 9

Crystallization – Equilibrium – Rate of crystal growth stage – Equilibrium crystallization Crystallizers – Equipment – Classification – Construction and operation – Crystallizers – Tank Agitated batch – Swenson – Walker and Vacuum crystallizers – Distillation – Binary mixtures – Flash and differential distillation – Steam distillation – Theory – Continuous distillation with rectification – Vacuum distillation – Batch distillation – Operation and process – Advantages and limitation – Distillation equipments – Construction and operation – Factors influencing the operation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the fundamentals of evaporation and concentration
- Select suitable mechanical separators for different agricultural processing
- Analyze the Characteristics and principles of size reduction
- Explore the phenomenon of separation, absorption and extraction process
- Apply crystallization and distillation process in agricultural processing

TEXT BOOKS:

1. Sahay K M and Singh K K, "Unit Operations of Agricultural Processing", Vikas Publishing House Pvt Ltd, New Delhi, Reprints, 2004.
2. Geankoplis C J, "Transport Processes and Separation Process Principles", Pearson India Education Services Pvt. Ltd, 4th Edition, 2017.

REFERENCES:

1. Earle R L and Earle M D, "Unit Operations in Food Processing", The New Zealand Institute of Food Science and Technology Inc, 2nd Edition, 1989.
2. McCabe W L, Smith J C and Harriot P, "Unit Operations of Chemical Engineering", McGraw - Hill Inc, Kosaido Printing Ltd, 7th Edition, Tokyo, 2017.
3. Coulson J M and Richardson J F, "Chemical Engineering", Volume I to V, The Pergamon Press, New York, 2nd Revised Edition, 1999.

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20AG402	FARM TRACTORS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be made to:

- Gain knowledge on classification of tractors and tractor engine
- Understand the basic concepts of various systems in engine
- Illustrate the principle of transmission systems in tractor
- Explore the principles and operation of hydraulic systems
- Impart knowledge in power tiller, bulldozer and tractor engine

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.

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 TRANSMISSION SYSTEMS **9**

Transmission – clutch – gear box – sliding mesh – constant mesh – synchro mesh. Differential, final drive and wheels. Steering geometry – steering systems – front axle and wheel alignment. Brake – types – system.

UNIT IV HYDRAULIC SYSTEMS **9**

Hydraulic system – working principles, three point linkage – draft control – weight transfer, theory of traction – tractive efficiency – tractor chassis mechanics – stability – longitudinal and lateral. Controls – visibility – operators seat.

UNIT V POWER TILLER, BULLDOZER AND TRACTOR TESTING **9**

Power tiller – special features – clutch – gear box – steering and brake. Makes of tractors, power tillers and bulldozers. Bulldozer – salient features – turning mechanism, track mechanism, components – operations performed by bulldozers. Types of tests – test procedure – need for testing & evaluation of farm tractor – Test code for performance testing of tractors and power tillers.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe the working and construction of tractor and engine components
- Familiarize with the subsystem of tractor engine
- Explain the various components in transmission systems
- Develop skills on safe and efficient use of tractors
- Acquire knowledge on test procedure to assess the performance of tractors and power tillers

V. Gopal

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TEXTBOOKS:

1. Jain S C and Rai C R, "Farm Tractor Maintenance and Repair", Standard Publishers and Distributors, New Delhi, 2012.
2. John B Liljedahl, Paul K Turnquist, David W Smith and Makoto Hoki, "Tractors and their Power Units", CBS Publishers & Distributors, New Delhi, 4th Edition, 2004.

REFERENCES:

1. Domkundwar A V, "A Course in Internal Combustion Engines", Dhanpat Rai & Co. Pvt. Ltd, Delhi, 2018.
2. Black P O, "Diesel Engine Manual", D B Taraporevala Sons & Co.Pvt. Ltd, Mumbai, 1996.
3. Crouse W H and Anglin D L, "Automative Mechanics", Macmillan McGraw- Hill, 10th Edition, New Delhi, 2017.

CHAIRMAN
BoS (AGE)

20AG403	THEORY OF MACHINE AND MACHINE ELEMENTS DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be made to:

- Understand the basic types of mechanisms, links and joints arrangement
- Illustrate terminologies of cam, follower and gear trains
- Explain the types and selection of power transmission system
- Explore the design of shafts and couplings
- Discuss the design principles of gears and bearings

(Use of PSG Design Data book is permitted)

UNIT I BASICS OF MECHANISMS **9**

Basic Mechanisms and its terminologies – Degree of freedom – Mobility – Kutzbach criterion – Grubler's criterion for Planar Mechanisms – Grashof's law – Kinematic inversions of Four bar chain – Single slider – Double slider Crank Chains – Quick Return Mechanisms – Mechanical advantage – Classification of Mechanisms.

UNIT II CAM, FOLLOWER AND GEAR TRAINS **9**

Cam and follower – types – application – displacement diagrams – profile layout for uniform velocity – Uniform acceleration and retardation – simple harmonic and cycloidal motion.
Gears – classification – terminology – law of gearing – tooth profile – interference between rack and pinion. Gear trains – simple – compound reverted – epicyclic gear trains.

UNIT III DESIGN OF POWER TRANSMISSION SYSTEMS **9**

Selection of V-Belts and pulleys – flat belts and pulleys – wire ropes and pulleys – chains and sprockets.

UNIT IV DESIGN OF SHAFTS AND COUPLINGS **9**

Design of solid and hollow shafts based on strength and rigidity – Design of keys, keyways and splines – Design of rigid and flexible couplings. Design of bolts and nuts – knuckle and cotter joints.

UNIT V DESIGN OF GEARS AND BEARINGS **9**

Gears – spur gear and helical gear – terminology – strength of gear teeth – Lewis equation – Buckingham equation. Failure of gear teeth – Applications of different types of Gears – Types of bearings – sliding contact and rolling contact types. Bearing selection based on application – Lubrication in journal bearings – calculation of bearing dimensions.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the various methods of mechanisms for agriculture application
- Describe the working concept of cam, follower and gear train mechanism
- Familiarize with the selection of power transmission systems
- Analyze design criteria of shafts and couplings
- Explain the design procedure of gears and bearings

TEXTBOOKS:

1. Khurmi R S and Gupta J K, "Theory of Machines", S.Chand & Company Pvt. Ltd, 14th Edition, 2020.
2. Bhandari V B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 4th Edition, 2017.

REFERENCES:

1. Rattan S S, "Theory of Machines", McGraw Hill Education India Pvt. Ltd, 5th Edition, 2017.
2. John J Uicker Jr, Gordon R Pennock and Joseph E Shigly, "Theory of Machines and Mechanisms - SI Edition", Oxford University Press, 4th Edition, 2014.
3. Khurmi R S and Gupta J K, "A Textbook of Machine Design", S.Chand & Company Pvt. Ltd, 25th Edition, 2020.

CHAIRMAN
BoS (AGE)

20AG404	SOIL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be made to:

- Gain knowledge on Soil physical parameters and plant nutrient
- Understand of soil classifications and preparation of survey reports
- Introduce the soil phase relations, atterberg limits and soil compaction
- Learn the properties of soil and permeability
- Impart knowledge in bearing capacity and slope stability

UNIT I INTRODUCTION AND SOIL PHYSICS 9

Soil – definition – major components – Soil forming minerals and processes – soil profile – Physical properties – texture – density – porosity – consistence – colour – specific gravity – capillary and non-capillary – plasticity. Soil air – soil temperature – soil water – classification of soil water – Movement soil water. Soil colloids – organic and inorganic matter – Ion exchange – pH – Plant nutrient availability.

UNIT II SOIL CLASSIFICATION AND SURVEY 9

Soil taxonomy – Soils of Tamil Nadu and India. Soil survey – types and methods of soil survey – Field mapping- mapping units – base maps – preparation of survey reports – concepts and uses – land capability classes and subclasses – soil suitability – Problem soils – Reclamation.

UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION 9

Phase relations – Gradation analysis – Atterberg Limits and Indices – Engineering Classification of soil – Soil compaction – factors affecting compaction – field and laboratory methods.

UNIT IV ENGINEERING PROPERTIES OF SOIL 9

Shear strength of cohesive and cohesionless – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear, Triaxial and vane shear test – Permeability – Coefficient of Permeability – Darcy's law – field and lab methods – Assessment of seepage – Compressibility.

UNIT V BEARING CAPACITY AND SLOPE STABILITY 9

Bearing capacity of soils – Factors affecting Bearing Capacity – Shallow foundations – Terzaghi's formula – BIS standards – Slope stability – Analysis of infinite and finite slopes – friction circle method slope protection measures.

TOTAL: 45 PERIODS

V. Gore

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Describe the various minerals and organic components of soils including how changes in various quantities affect soil physical properties
- Familiarize with the soil types, field mapping, survey report and soil suitability
- Apply principles of phase diagram for soil properties, their classification and also understand the basic science of soil compaction
- Learn the concept of engineering properties through standard tests and understand principles of slow and soil permeability through porous medium
- Understanding the basic concepts of ultimate bearing capacity of shallow foundations including bearing capacity equations and slope stability problems

TEXTBOOKS:

1. Nyle C Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, New York, 10th Edition, 2008.
2. Punmia B C, Ashok Kumar Jain and Arun Kumar Jain "Soil Mechanics and Foundation" Laxmi Publishers, New Delhi, 16th Edition, 2017.

REFERENCES:

1. Edward J Plaster, "Soil Science and Management", Delmar Cengage Learning India Ltd, New Delhi, 6th Edition, 2013.
2. Arora K R, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Reprint, 2019.
3. Murthy V N S, "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 2018.
4. Sehgal S B, "Text Book of Soil Mechanics", CBS Publishers and Distributors, New Delhi, 3rd Edition, 2012.

CHAIRMAN
BoS (AGE)

20EC407 INTRODUCTION TO SENSORS AND ACTUATORS

L	T	P	C
3	0	0	3

OBJECTIVES:

The students should be made to:

- Understand static and dynamic characteristics of measurement systems.
- Study about various types of sensors for different applications.
- Understand the design concepts and signal conditioning of self generating sensors.
- Understand the concept of Signal conditioning and self-generating motors.
- Study about the performance of digital and semiconductor sensors.

UNIT I INTRODUCTION TO MEASUREMENT SYSTEMS **9**

Introduction to measurement systems: general concepts and terminology, measurement systems, sensor classification, general input-output configuration, methods of correction, performance characteristics: static characteristics of measurement systems, accuracy, precision, sensitivity, other characteristics: linearity, resolution, systematic errors, random errors.

UNIT II RESISTIVE AND REACTIVE SENSORS **9**

Resistive sensors: potentiometers, strain gages, resistive temperature detectors, magneto resistors, Signal conditioning for resistive sensors: Wheatstone bridge, sensor bridge calibration and compensation, sources of interference and interference reduction, Reactance variation and electromagnetic sensors, inductive sensors, linear variable differential transformers (LVDT), magneto elastic sensors, hall effect sensors.

UNIT III SELF-GENERATING SENSORS **9**

Self-generating sensors: thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors, Signal conditioning for self-generating sensors: chopper and low-drift amplifiers, offset and drifts amplifiers, electrometer amplifiers, charge amplifiers, noise in amplifiers.

UNIT IV ACTUATORS DRIVE CHARACTERISTICSANDAPPLICATIONS **9**

Relays, Solenoid drive, Stepper Motors, Voice-Coil actuators, Servo Motors, DC motors and motor control, 4-to-20 mA Drive, Hydraulic actuators, variable transformers: synchros, resolvers, Introduction, resolver-to-digital and digital-to-resolver converters.

UNIT V DIGITAL SENSORS AND SEMICONDUCTORDEVICESENSORS **9**

Digital sensors: position encoders, variable frequency sensors - quartz digital thermometer, vibrating cylinder sensors, saw sensors, digital flow meters, Sensors based on semiconductor junctions: thermometers based on semiconductor junctions, photodiodes and phototransistors, sensors based on MOSFET transistors, CCD imaging sensors, ultrasonic sensors, fiber - optic sensors.

TOTAL: 45 PERIODS

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BoS (AGE)

OUTCOMES:

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

- Understand how physical quantities are measured and how they are converted to electrical or other forms.
- Explain the construction and operation of variable resistance transducer and demonstrate the knowledge of inductance transducers.
- Utilize the Self-generating sensors in application.
- Understand working principles of actuators and its characteristics.
- Design State-of-the-art digital and semiconductor sensors.

TEXT BOOKS:

1. Clarence W. de Silva, "Sensors and Actuators Control Systems Instrumentation", CRC Press, 2016.
2. Nathan Ida, "Sensors, Actuators, and their Interfaces" A Multidisciplinary Introduction University of Akron, SciTech Publishing, an imprint of the IET, 2014.

REFERENCES:

1. Andrzej M. Pawlak, "Sensors and Actuators in Mechatronics Design and Applications", 2007.
2. Johnson D, "Process Control Instrumentation Technology", John Wiley and Sons, 8th Edition, 2014.
3. Patranabis, "Sensors and Transducers", Prentice Hall India Pvt. Ltd, 2nd Edition, 2003.
4. Herman K P. Neubrat, "Instrument Transducers - An Introduction to Their Performance and Design", Oxford University Press, 2nd Edition, 1975.

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BoS (ECE)

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BoS (AGE)

20MC003	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

The student should be made to:

- To teach history and philosophy of Indian constitution.
- To summarize powers and functions of Indian government.
- To explain structure and functions of local administration.
- To demonstrate the organization and working of the Judiciary.
- To discuss financial power and emergency provisions.

UNIT I 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 Loksabha and Rajyasabha – 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– Powers, Authority and Responsibilities of 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-Underlaying distribution of tax revenues-Distribution of legislative power – Interstate relation - Emergency provisions.

TOTAL: 30 PERIODS

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BoS/S&H

OUTCOMES:

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

- Understand history and philosophy of Indian constitution
- Realize powers and functions of Indian government
- Acquire awareness on structure and functions of local administration
- Enhance knowledge about organization and composition of judiciary
- Explore the distribution of financial powers and emergency provisions

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,NewDelhi, 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, Seventh Edition, Lexis Nexis, 2014.
5. Busi S N, Ambedkar B R framing of Indian Constitution, First Edition, 2015.

Chairman
BoS/S&H

20AG405L	SOIL SCIENCE LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student should be made to:

- Students will be able to identify the types of rocks and minerals.
- Students should be able to verify various quality aspects of soil and water studied in theory by performing experiments in lab.
- To provide hands on experience on the textural analysis of soil.
- Students should be able to determine the organic carbon and gypsum requirements.
- Students should be able to perform in situ tests on soil samples.

List of Experiments

1. Identification of rocks and minerals
2. Collection and processing of soil samples
3. Determination of soil moisture, EC and pH
4. Field density determination by Core Cutter and Sand Replacement method
5. Specific gravity determination by Pycnometer
6. Textural analysis of soil by International Pipette method
7. Grain size analysis by using Mechanical shaker
8. Determination of Organic carbon
9. Estimation of Gypsum requirements

TOTAL: 30 PERIODS

OUTCOMES:

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

- Learn about the identification of minerals referred under theory
- Knowledge of field investigations including collection of soil sampling, Processing and storage through observation of soil
- Understanding of the physical properties of soil and different laboratory methods
- Perform test to identify the organic carbon and application of soil amendments through chemical analysis of soil
- Determine various physical and chemical properties of soil that are applicable for agriculture and irrigation by conducting appropriate tests

REFERENCES:

1. Punmia B C, "Soil Mechanics and Foundation Engineering", Laxmi Publishers, New Delhi. 2007.
2. Laboratory Manual, "Centre for Water Resources, Anna University", Chennai. 2012

V.Gopi

CHAIRMAN
BoS (AGE)

20EC408L	SENSORS AND ACTUATORS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

The student should be made to,

- Learn the fundamental Concepts of sensors and transducers
- Understand the Characteristics of LVDT
- Know the Basic Concepts of optical sensors performance
- Impart the Knowledge of proximity sensors
- Study the loading effects of potentiometer and hall effect sensor

LIST OF EXPERIMENTS:

1. Measurement of strain using strain gauges
2. Characteristics of temperature sensors
3. Study of AC and DC Characteristics of LVDT
4. Measurement of Natural frequency and damping ratio of the given system
5. Loading effects of Potentiometer and Characteristics of Opto coupler
6. Level Measurement using proximity sensors
7. Loading Effects of Potentiometer and Characteristics of Opto coupler
   7.1 Loading Effects of Potentiometer
8. Characteristics of Hall effect sensor.

TOTAL: 45 PERIODS

OUTCOME:

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

- Know the fundamentals of sensors and transducers and its performance
- Incorporate the LVDT Concepts into their electronic design
- Apply the optical sensors fundamentals in future designs
- Comprehend the basic requirements and layout of microprocessor
- Solve the real world control problems as applications

CHAIRMAN
BoS (ECE)

20EEC401L	LIFE SKILLS AND PERSONALITY DEVELOPMENT (COMMON TO ALL BRANCHES)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student 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 behavior – Formation of attitudes – Evolving Behavior 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

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BoS (AGE)

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

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. NiraKonar, "Communication Skills for Professionals", Eastern Economy Edition, 2010.
4. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.

CHAIRMAN
BoS (S&H)

CHAIRMAN
BoS (AGE)

20AG501	IRRIGATION AND DRAINAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Know the basic knowledge of water resources, Crop water relationship and Irrigation
- Acquire a fundamental understanding of different irrigation methods
- Get familiarize in water storage structures
- Impart knowledge on the water distribution system and on-farm development work
- Learn in detail about the agricultural drainage system and recycling of drainage water

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

Water Resources – River basins – Development and Utilization in India and Tamil Nadu – Irrigation – duty and delta – Rooting characteristics – Moisture use of crop, Evapotranspiration – ET plot – Crop water requirement – Effective rainfall – Scheduling – Irrigation requirement – Irrigation frequency and Irrigation efficiencies.

UNIT II METHODS OF IRRIGATION 9

Methods of Irrigation – Surface and Subsurface methods – Drip and Sprinkler – Hydraulics and design – Erodible and non-erodible, Kennedy's and Lacey's theories, Materials for lining water courses and field channel, Water control and diversion structure – Underground pipeline irrigation system.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Head works – Weirs and Barrage – Types of impounding structures – Factors affecting, location of dams – Forces on a dam – Design of Gravity dams – Earth dams, Arch dams – Spillways – Energy dissipaters.

UNIT IV CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Classification of canals – Alignment of canals – Design of irrigation canals – Regime theories – Canal Head works – Canal regulators – Canal drops – Cross drainage works – Canal Outlet, Escapes – Lining and maintenance of canals – Excess irrigation and waterlogging problem – Command area – Concept, Components of CADP – On Farm Development works, Farmer's committee – its role for water distribution and system operation – rotational irrigation system.

UNIT V AGRICULTURAL DRAINAGE 9

Agricultural drainage – Drainage coefficient; principles of flow through soils, Darcy's law - infiltration theory, Surface drainage systems – Subsurface drainage – Design of subsurface drainage – Pipe materials – mole drains, drainage wells, Leaching requirements – irrigation and drainage water quality – recycling of drainage water for irrigation.

TOTAL: 45 PERIODS

V. GOPAL

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Elaborate the water resources and requirement of irrigation
- Select suitable irrigation methods based on crop nature, soil nature and topography
- Apply the analytical skills on design, operation and manage of water reservoir system
- Illustrate the canal classification, alignment and design of canals
- Gain knowledge on agricultural drainage systems and select suitable drainage systems for effective crop production

TEXTBOOKS:

1. Michael A M, "Irrigation Engineering", Vikas Publishers, New Delhi, 2nd Edition, 2008.
2. Ritzema H P, "Drainage Principles and Applications", International Institute of Land Reclamation and Improvement, Netherlands, Revised Edition, 1994.

REFERENCES:

1. Basak N N, "Irrigation Engineering", Tata McGraw - Hill Publishing Co Ltd., New Delhi, 2017.
2. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice - Hall of India, New Delhi, 2nd Edition, 2013.
3. Kessler J, "Drainage Principles and Applications", International Institute of Land Reclamation and Improvement, Netherlands, 1979.

CHAIRMAN
BoS (AGE)

20AG502	FARM MACHINERY AND EQUIPMENT S	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn about the basic principles of farm mechanization and tillage
- Identification of primary and secondary tillage implements and knows about their usage
- Impart knowledge on principle involved and methods of sowing and fertilizing equipments
- Illustrate the various equipments in weeding and protection of plant
- Understand the working principle of harvesting machinery

UNIT I FARM MECHANIZATION **9**

Farm mechanisation – objectives. Tillage – objectives – methods – primary tillage implements – secondary tillage implements – animal drawn ploughs – construction. Types of farm implements – trailed, mounted. Field capacity – forces acting on tillage tool.

UNIT II PRIMARY AND SECONDARY TILLAGE IMPLEMENTS **9**

Mould board plough – attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough – Rotary plough. Cultivators – types – construction. Disc harrows – Bund former – ridger – leveller. Basin lister – Wetland preparation implements.

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 – dryland 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

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OUTCOME:

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

- Understand the mechanization and various equipment used in the farm for different field operations
- Identify the suitable tillage implement for different types of tillage operations based on soil texture and purpose
- Select and test the suitable sowing equipments and fertilizer applicators
- Possess the knowledge on weeding equipments and various sprayers
- Gain deep knowledge about on operation of harvesting machinery and equipments

TEXTBOOKS:

1. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publishers Distributors, New Delhi, 2020.
2. Michael and Ohja, "Principles of Agricultural Engineering", Jain brothers, New Delhi, 14th Edition, 2021.

REFERENCES:

1. Kepner RA, "Principles of Farm Machinery", CBS Publishers and Distributers, New Delhi, Kindle Edition, 2018.
2. Harris Pearson Smith, "Farm machinery and equipment", Tata McGraw-Hill publication, New Delhi, Kindle Edition, 2015.

V. Gopie

CHAIRMAN
BoS (AGE)

20ME505PE	REFRIGERATION AND AIR CONDITIONING (COMMON TO MECH AND AGE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Familiarise with the basic principles and concepts of refrigeration applied in the engineering practice
- Understand the fundamentals of refrigeration system components, properties of refrigerants and applications of refrigeration systems
- Learn about Psychrometric processes and its properties
- Gain knowledge on different air conditioning systems
- Study the cooling load calculations in various systems

(Use of standard Refrigerant Property Data Book and Psychrometric Charts are permitted)

UNIT I REFRIGERATION CYCLE **9**

Review of thermodynamic principles of refrigeration – Air cycle refrigeration system – Vapour compression refrigeration cycle – use of P-H charts – multistage and multiple evaporator systems – cascade system – COP comparison – Vapour absorption refrigeration system. Ammonia water and Lithium – Bromide water systems – Steam jet refrigeration system.

UNIT II REFRIGERATION SYSTEM COMPONENTS AND REFRIGERANTS **9**

Compressors: Types – based on operation and based on arrangement – Condensers: Types-air cooled, water cooled and evaporative condensers – Evaporators: Flooded and dry expansion types – Expansion devices: Capillary tube, Automatic expansion valve, Thermostatic expansion valve – Refrigerants: Properties and Selection – Eco friendly refrigerants: Ozone Depletion Potential (ODP) and Global Warming Potential (GWP).

UNIT III PSYCHROMETRIC PROCESSES **9**

Review of fundamental properties of psychrometry, Psychrometric chart, Psychrometry properties calculation, Psychrometric processes, Bypass factor, Apparatus Dew Point (ADP) temperature, numerical problems.

UNIT IV AIR CONDITIONING SYSTEMS **9**

Air conditioning – definition, standards of temperature, humidity and air motion, components of air conditioning system – Summer, winter and year – round air conditioners, Window, Split air conditioners, Central air conditioner systems – Air distribution system – Thermal insulation of air conditioning systems – applications.

UNIT V COOLING LOAD CALCULATIONS **9**

Types of load – design of space cooling load – heat transmission through building – Solar radiation – infiltration – internal heat sources (sensible and latent) – outside air and fresh air load – estimation of total load – Domestic, commercial and industrial systems – central air conditioning systems.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (MECH)

OUTCOMES:

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

- Apply the basic concepts and terms involved in refrigeration and Air-Conditioning systems like refrigerants, refrigeration cycle, compressor, COP etc.,
- Describe knowledge on different types of compressors and different types of refrigerants
- Demonstrate thorough understanding of Psychrometric chart and its usage
- Conversant with Air-Conditioning systems for car, stores and public buildings
- Learn Cooling load calculations for different types of Air-Conditioning requirements like domestic, commercial and industrial systems

TEXT BOOKS:

1. Rajput R K, "Refrigeration and Air-Conditioning", S K Kataria Sons, 3rd Edition, 2015.
2. Khurmi R S, "Refrigeration and Air-Conditioning", S Chand, 2011.

REFERENCES :

1. Manohar Prasad, "Refrigeration and Air-Conditioning", Wiley Eastern Ltd., 2010.
2. Ramesh Arora, "Refrigeration and Air-Conditioning", Prentice Hall of India, 2010.
3. Arora and Domkundwar, "Refrigeration and Air-Conditioning", Dhanpat Rai and Co, 2009.
4. Stocker W F and Jones J W, "Refrigeration and Air-Conditioning", McGraw Hill, 2009.
5. Arora C P, "Refrigeration and Air-Conditioning", Tata McGraw Hill, New Delhi, 4th Edition, 2021.

CHAIRMAN
BoS (MECH)

20EC701	EMBEDDED AND REAL TIME SYSTEMS (COMMON TO CSE, ECE AND AGE)	L T P C 3 0 0 3

OBJECTIVE:
The students should be made to

- Learn the architecture of ARM7 and Assembly language code for ARM7 processor.
- Understand the embedded computing platform design and software performance.
- Expose the basic concepts of real time Operating system and scheduling algorithm.
- Design techniques and networks for embedded systems.
- Analyze the applications of embedded Control systems.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS **9**

Complex systems and micro processors - Embedded system design process - Design example: Model train controller - Instruction sets preliminaries - ARM Processor - CPU: programming input and output - supervisor mode, exceptions and traps - Co- processors - Memory system mechanisms - CPU performance - CPU power consumption.

UNIT II EMBEDDED COMPUTING PLATFORM DESIGN **9**

The CPU Bus - Memory devices and systems - Designing with computing platforms - consumer electronics architecture - platform - level performance analysis - Components for embedded programs - Models of programs - Assembly, linking and loading - compilation techniques - Program level performance analysis - Software performance optimization - Program level energy and power analysis and optimization - Analysis and optimization of program size - Program validation and testing.

UNIT III PROCESSES AND OPERATING SYSTEMS **9**

Introduction - Multiple tasks and multiple processes - Multirate systems - Preemptive real-time operating systems-Priority based scheduling - Interprocess communication mechanisms - Evaluating operating system performance-power optimization strategies for processes.

UNIT IV SYSTEM DESIGN TECHNIQUES AND NETWORKS **9**

Design methodologies - Design flows - Requirement Analysis - Specifications - System analysis and architecture design - Quality Assurance techniques - Distributed embedded systems - MPSoCs and shared memory multiprocessors.

UNIT V CASE STUDY **9**

Data compressor - Alarm Clock - Software modem - Telephone answering machine - Audio player - Digital still camera - Video accelerator.

TOTAL: 45 PERIODS

Chairman
BoS/ECE

OUTCOME:

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

- Summarize Architecture and programming of ARM processor.
- Applying the concepts of embedded systems and its features.
- Analyze various Real time Operating system is used in Embedded System.
- Design the flow & Techniques to develop Software for embedded system networks.
- Analyze Real-time applications using embedded System Products.

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

REFERENCES:

1. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition Cengage Learning, 2012.
2. David. E. Simon, "An Embedded Software Primer", 1st Edition, 5th Impression, Addison-Wesley Professional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems - From Design to Networking with C/C++", Prentice Hall, 1999.
4. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.
5. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.

Chairman
BoS/ECE

20AG503L	IRRIGATION FIELD LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVE:

The student should be made to:

- Study the various meteorological instruments and calculate the various meteorological aspects related to irrigation
- Gain knowledge about how to design various types of irrigation systems
- Impart knowledge on flow properties in open channels
- Evaluate the uniformity coefficient of the various irrigation systems
- Develop knowledge on micro irrigation system

LIST OF EXPERIMENTS

1. To study various instruments in the Meteorological Laboratory.
2. Determination of infiltration rate using double ring and digital infiltrometer.
3. Determination of soil moisture wetting pattern for irrigation scheduling.
4. Design of Drip irrigation system.
5. Design of sprinkler irrigation system.
6. Measurement of flow properties in open irrigated channels (flumes, notches).
7. Evaluation of surface irrigation.
8. Determination of uniformity coefficient for drip irrigation system.
9. Determination of uniformity coefficient for sprinkler system (catch can method).
10. To conduct experiment on disc filter for micro irrigation systems.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS REQUIRED

1. Meteorological lab with Cup counter anemometer, Sunshine recorder, Open pan vaporimeter, Stevenson's screen – Dry bulb, wet bulb thermometers, recording and non-recording type rain gauge etc. – each 1 no.
2. Double ring infiltrometer – 1 no.
3. Digital infiltrometer – 1 no.
4. Parshall flume, cut throat flume – 1 no. each
5. V notch, Rectangular notch and trapezoidal notch – 1 no. each
6. Drip irrigation system with all accessories
7. Sprinkler irrigation system with all accessories
8. Required number of stop watches
9. Weighing balance – 1 no.
10. Catch cans, measuring jars – required numbers.

V. GOPAL

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Impart practical knowledge about meteorological instruments used in irrigation systems
- Design suitable irrigation systems for crop production
- Illustrate the various flow properties measurement in open channels
- Analyze the uniformity coefficient for drip and sprinkler irrigation systems
- Understand the significance of micro irrigation systems in effective crop production

REFERENCES:

1. Michael A M, "Irrigation Theory and Practice", S Chand Publication, New Delhi, 2nd Edition, 2008.
2. Michael A M, "Irrigation Engineering", Vikas Publishers, New Delhi, 2nd Edition 2008.

CHAIRMAN
BoS (AGE)

20EC703L	EMBEDDED LABORATORY (COMMON TO ECE AND AGE)	L T P C 0 0 3 1

OBJECTIVE:

The students should be made to

- Understand the Building Blocks of Embedded Systems with ARM processor
- Learn the interfacing procedure of various devices such as ADC- DAC, PWM-LED
- Analyze performance of processor by interfacing keyboard, display, motor and sensor.
- Evaluate the interrupt performance of ARM and FPGA processor.
- Apply the knowledge of interfacing between zigbee protocol with ARM processor

LIST OF THE EXPERIMENTS

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

IOT EXPERIMENTS

1. Interface LED / Buzzer with Arduino / raspberry pi
2. Interface sensor with Arduino / raspberry pi

TOTAL: 45 PERIODS

OUTCOME:

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

- Design a ARM for the specific application by the way of basic building blocks of embedded system.
- Implement various interfacing mechanism and observe the performance by using in KEIL software.
- Analyze performance of ARM processor by interfacing keyboard, display, motor and sensor.
- Evaluate the interrupt performance of ARM processor by using in KEIL software.
- Apply the interfacing knowledge between zigbee communication protocols and IoT modules

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Embedded trainer kits with ARM board.
2. Embedded trainer kits suitable for wireless communication.
3. Adequate quantities of Hardware, software and consumables.

Chairman
BoS/ECE

20EEC501L	PROFESSIONAL SKILLS DEVELOPMENT (COMMON TO ALL BRANCH)	L T P C 0 0 2 1

OBJECTIVES:

The student should be made to,

- Sharpen problem solving skills and to improve thinking ability of the students
- Drive the students to use language with great commitment and cooperation
- Expertise the creative thinking and presentation skills to meet company needs
- Develop and foster the soft skills through individual and group activities
- Expose students to right attitudinal and behavioral thoughts

UNIT I INTRODUCTION TO BASIC ARITHMETIC & PERSONALITY TRAITS **6**

Aptitude – Numbers, Average, Percentage, Profit & 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 & work, Pipes and cisterns, Series completion, Critical reasoning

Soft skills – Developing self esteem, Significance of interpersonal behavior and interpersonal relationships

UNIT III AN APPROACH TO COGNITIVE APTITUDE & LEADERSHIP SKILLS **6**

Aptitude – Time, speed and distance, Boats and streams, Races and games, Syllogism

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

UNIT IV CONTEMPORARY APTITUDE & SITUATIONAL RESPONSES **6**

Aptitude – Crypt arithmetic, Ranking, Logarithms, Cubes, Analogy

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

UNIT V NON-VERBAL REASONONG & 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

Chairman
BoS/S&H

TEXT BOOKS:

1. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing New Delhi, Revised Edition Feb 2017.
2. G. R. K. Murty, "Soft Skills for Success", DGM Icfai Books, Revised Edition 8th Feb 2005.

REFERENCES :

1. Abhijit Guha, "Quantitative Aptitude for All Competitive Examinations", McGraw Hill Education; Sixth edition (25 November 2016)
2. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing; New Delhi, Revised edition
3. Arun Sharma, "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education; Eighth edition (5 June 2018)
4. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
5. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.

Chairman
BoS/S&H

20AG601	GROUNDWATER AND WELL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the concepts of groundwater and its utilization
- Impart knowledge on groundwater dynamics and well hydraulics
- Acquire knowledge about well design and materials
- Illustrate the importance of well construction and its maintenance
- Know the techniques of artificial groundwater recharge and modelling techniques

UNIT I HYDROGEOLOGIC PARAMETERS **9**

Water Balance – Distribution of subsurface water – Water bearing properties of Rocks – Types of Aquifers – Aquifer properties Estimation – Pumping test – Permeability, Specific yield, transmissivity and Storage coefficient – Methods of Estimation – Groundwater table fluctuation method – GEC Norms – Groundwater development and potential in India – Groundwater prospectives - Geophysical techniques – Electrical resistivity survey.

UNIT II WELL HYDRAULICS **9**

Darcy's law – Groundwater Flow Equation – Steady state flow – Dupuit Forcheimer Assumption – Theim's Equation – unsteady flow – Theis method and Jacob method – Image well theory – Partial penetration of wells.

UNIT III WELL DESIGN **9**

Design characteristics – Design of wells – Well diameter, depth and Well screen design –Materials for well screens – Well casing – Design of collector wells and Infiltration gallery – Dug wells versus tube wells.

UNIT IV WELL CONSTRUCTION AND MAINTENANCE **9**

Types of wells – Well drilling - Boring, Jetting – Rotary drilling, Hammer drilling - Construction – Installation of pipes and screens – Well development, Completion and disinfection – Well maintenance – Well performance test – Well effectiveness – Well loss – Pumping equipment – Rehabilitation of wells and borewells.

UNIT V SPECIAL TOPICS **9**

Artificial Recharge Techniques – Sea water Intrusion – Introduction to Groundwater modeling Techniques – Groundwater pollution and legislation - Groundwater quality – Dose response assessment – Risk analysis.

TOTAL: 45 PERIODS

V.Gopi
CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Know the technical aspects of groundwater and its utilization
- Analyze the steady and unsteady flow for well hydraulics
- Design the well hydraulics for various applications
- Explore the various well construction parameters and well maintenance
- Assess the quality of ground water and pollution of groundwater

TEXTBOOKS:

1. Karanth K R, "Groundwater Assessment, Development and Management", Tata McGraw Hill, 2017.
2. Raghunath H M, "Groundwater", New Age International Publishers, 3rd Edition, 2007.

REFERENCES:

1. David K Todd and Larry W Mays, 'Groundwater Hydrology', Wiley India Pvt. Ltd., 3rd Edition, 2011.
2. Rastogi A K, "Numerical Groundwater Hydrology", Penram International Publishing. Pvt. Ltd., Bombay, 2007.
3. Kumar P, "Ground Water and Well Drilling", CBS Publishers and Distributors Pvt. Ltd., 2018.
4. Fletcher G Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987.

V.GODE
CHAIRMAN
BoS (AGE)

20AG602	POST HARVEST TECHNOLOGY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The student should be made to,

- Understand the fundamental knowledge in post harvest operations
- Acquire a basic knowledge on psychrometry and drying principles in agriculture crops
- Introduce the principle of cleaning and grading machineries used in agriculture
- Identify the various operations of shelling and handling machinery
- Get familiarize with different processing methods of harvested crops

UNIT I FUNDAMENTALS OF 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 –measurement – direct and indirect methods – moisture meters – equilibrium moisture content.

UNIT II PSYCHROMETRY AND DRYING **9**

Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers.

UNIT III 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.

UNIT IV SHELLING AND HANDLING **9**

Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling – belt conveyor – screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.

UNIT V CROP PROCESSING **9**

Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing – layout of modern rice mill – wheat milling – pulse milling methods – oil seed processing – millets processing.

TOTAL: 45 PERIODS

V. GOPI

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Apply basics knowledge of post-harvest techniques into the handling of crops after the harvest
- Use different types of dryers in the drying process in agriculture crops
- Handle the cleaning, grading, separation and various process equipment in post-harvest processing
- Analyze the various shelling and handling equipments
- Discuss the modern rice mill, oil seed processing and millets processing

TEXTBOOKS:

1. Chakraverty A, "Post harvest technology for Cereals, Pulses and oil seeds", Oxford & IBH publication Pvt Ltd, New Delhi, 3rd Edition, 2019.
2. Sahay K M and Singh K K, "Unit operations of Agricultural Processing", Vikas publishing house Pvt. Ltd., New Delhi, 2nd Revised and Enlarged edition, 2004.

REFERENCES:

1. Pandey P H, "Principles of Agriculture Processing", Kalyani Publishers, 2006.
2. Henderson S M and Perry R L, "Agricultural Process Engineering", John Wiley and Sons, New York, 1976.
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.

LIST OF EXPERIMENTS:

1. Determination of moisture content of grains by oven method and moisture meter
2. Determination of porosity of grains
3. Determination of coefficient of friction and angle of repose of grains
4. Testing of paddy thresher & paddy winnower
5. Testing of groundnut decorticator & maize sheller
6. Study of thin layer drier
7. Study of L.S.U. drier
8. Determining the efficiency of bucket elevator and screw conveyor
9. Evaluation of shelling efficiency of rubber roll sheller
10. Determining the oil content of oil seeds

TOTAL: 30 PERIODS

CHAIRMAN
BoS (AGE)

20AG603	SOIL AND WATER CONSERVATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the concepts of erosion, gully and spillway
- Estimate different types of soil erosion measures
- Acquire deep knowledge of agronomic practices, mechanical measures to control and prevent soil erosion
- Impart knowledge on water harvesting and water conservation measures
- Introduce the types of sedimentation, distribution patterns and sediment controlling methods

UNIT I SOIL EROSION PRINCIPLES **10**

Introduction –Approaches to soil conservation – Erosion – Agents – Causes – types– Mechanics of water erosion – Erosion agents; Factors affecting and effects of erosion– Soil erosion problems – Types of water erosion: Raindrop erosion Rainfall erosivity estimation by KE>25 and EI 30 methods, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully stages of development– Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways and vegetative measures – reclamation.

UNIT II ESTIMATION OF SOIL EROSION **9**

Runoff computation for soil conservation: Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation –Permissible erosion – Land use capability classification – Classification of eroded soils – Soil erodibility and other Management factors.

UNIT III EROSION CONTROL MEASURES **10**

Agronomic practices: contour cultivation – strip cropping – tillage practices – Soil management practices. Bunding: Types and design specifications – Mechanical measures for hill slopes. Terracing: Classification and design specification of bench terrace. Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures.

UNIT IV WATER CONSERVATION MEASURES **8**

In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis – Farm ponds: Components, Design, Construction and Protection – Check dams – Earthen dam – Retaining wall.

V. Gopi

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BoS (AGE)

UNIT V SEDIMENTATION **8**

Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed load – Sediment Graph. Reservoir sedimentation: Basics – Factors affecting sediment distribution pattern, Rates of reservoir sedimentation – Silt Detention Tanks – sediment control methods.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain fundamental knowledge on the concepts of soil erosion
- Apply soil estimation measures to estimate the soil erosion
- Adopt the different types of soil erosion measures to control the soil erosion
- Understand the concepts of water harvesting structures for in-situ soil moisture conservation
- Describe the sediment source and reservoir sedimentation

TEXTBOOKS:

1. Suresh R, "Soil and Water Conservation Engineering", Standard Publication, New Delhi, 2020.
2. Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2nd Edition, 2009.

REFERENCES:

1. Murthy V V N, "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 2013.
2. Gurmel Singh, "A Manual on Soil and Water Conservation Practices", Oxford and IBH Publications, 2019.
3. Mal B C, "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2011.

CHAIRMAN
BoS (AGE)

20EC606 IoT IN AGRICULTURAL ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Know the Networking and IoT concepts
- Learn about Connectivity Technologies, Sensors and Actuators for IoT
- Understand the Programming with Arduino for Agriculture applications
- Learn the Advanced Monitoring Systems in Agriculture
- Apply the concept of internet of things in the agricultural field

UNIT I INTRODUCTION TO NETWORKING AND IoT **9**

Networking: Introduction- Network Types: Connection Types, Physical Topology, Network Reachability - OSI Layers model - Data Link Layer Addressing- Network Layer Addressing (IPv4, IPv6).

IoT: Characteristics of IoT- IoT Architecture-IoT Device Design and selection considerations – IoT Enabling Technologies-Components of an Agricultural IoT.

UNIT-II IoT CONNECTIVITY TECHNOLOGIES, SENSORS AND ACTUATORS **9**

Connectivity Technologies: Bluetooth- Wi-Fi - Zigbee - RFID – **Sensors:** Basics of Sensors – Characteristics of Sensors – Classification of Sensors - Sensing Types -Sensing Considerations - **Actuators:** Basics of Actuators- Characteristics of Actuators- Types of Actuators.

UNIT III PROGRAMMING WITH ARDUINO **9**

Overview of Arduino - Arduino UNO Board - Arduino IDE - Basic commands- Blinking an LED, Interfacing an LED and Switch, **Interfacing of sensors with arudino:** PIR Sensor- -DHT Sensor- Ultrasonic Sensor-Soil Moisture Sensor- LDR, pH Sensor ,Turbidity sensors- **Interfacing of actuators with Arduino**: DC motor, Stepper motor, Servo motor.

UNIT IV ADVANCED MONITORING SYSTEMS IN AGRICULTURE **9**

Farming Automation: IoT Platforms for Smart Farming- Sensors used in Smart Farming- Agriculture Robots- Agriculture Drones- Advantages and Challenges of smart farming- **Smart e-agriculture monitoring Systems**:-Components- WSN based architecture, IoT-Cloud based architecture, IoT and data analytics in agriculture –Smart soil monitoring system-Hydroponic farming.

UNIT V IoT APPLICATIONS FOR AGRICULTURE **9**

Solar powered greenhouse monitoring system-Smart irrigation system-Weather monitoring system-Crop monitoring system-Fertilizer management system-Pest management-Precision livestock farming-Aquaculture monitoring system.

TOTAL : 45 PERIODS

CHAIRMAN
BOS/ECE

OUTCOMES:

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

- Understand the various concepts of Networking and IoT
- Identify the enabling technologies in the IoT systems
- Design and develop the IoT system with Arduino programming
- Analyze the Advanced Monitoring Systems in Agriculture
- Implement the IoT Applications for Agriculture

TEXT BOOKS:

1. Sudip Mishra, Anandarup Mukherjee and Arijit Roy, " Introduction to IoT", Cambridge University Press,2021.
2. Qusay F. Hassan," Internet of Things A to Z: Technologies and Applications", 2018 Wiley-IEEE Press.
3. Pradeep Tomar and Gurjit Kaur, "Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture"- IGI Global.

REFERENCES:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities press Pvt. Ltd., India, 2015.
2. Jeeva Jose, "Internet of Things", Khanna Book Publishing House, New Delhi,2018.
3. Megh R. Goyal, "Emerging Technologies in Agricultural Engineering", Apple Academic Press.
4. Rajesh Singh, Anita Gehlot, Bhupendra Singh & Sushabhan Choudhury, "Internet of Things (IoT) Enabled Automation In Agriculture".

ONLINE RESOURCES:

- https://www.electronicwings.com/arduino/basics
- https://www.javatpoint.com/arduino
- https://how2electronics.com/iot-smart-agriculture-automatic-irrigation-system-with-esp8266/
- https://nptel.ac.in/courses/108108098

CHAIRMAN
BOS/ECE

20EC607L	INTERNET OF THINGS LABORATORY	L T P C 0 0 3 1

OBJECTIVES:

The students should be made to

- Design and simulate the circuits using Tinkercad.
- Understand the sensors interfacing with Arduino controller.
- Analyze the Servo and DC motor interfacing with Arduino controller.
- Build the IoT system with NodeMCU.
- Know the modeling of mobile applications such as Blynk and ThingSpeak.

LIST OF THE EXPERIMENTS

1. Simulation of Blinking an LED and DC motor control with Arduino
2. Simulation of Ultrasonic Sensor interfacing with Arduino
3. IR Sensor interfacing with Arduino
4. LDR Sensor interfacing with Arduino
5. DHT11 Sensor interfacing with Arduino
6. Soil Moisture based Automatic Pump Control with Arduino
7. DC Motor forward and reverse control using Arduino
8. Servo Motor interfacing with Arduino
9. PIR Sensor interfacing with NodeMCU
10. DHT11 Sensor interfacing with NodeMCU and Blynk
11. Lamp Control using NodeMCU and Blynk
12. Distance Measurement using NodeMCU and Thingspeak

TOTAL: 45 PERIODS

OUTCOMES:

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

- Simulate the experiments using Tinkercad tool.
- Design the simple interfacing of sensors and Arduino controller.
- Demonstrate the actuators interfacing with Arduino controller.
- Implement the NodeMCU based IoT controlled systems.
- Create the mobile applications for automations for agriculture.

Chairman
BoS/ECE

20AG604L	MINI PROJECT-I	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the current technology
- Identify the real time problem
- Understand the new tools and techniques for the problem
- Verify the results in design and experiment solutions
- Promote team work and develop the presentation skills

GUIDELINES FOR REVIEW AND EVALUATION

The students in a group of not more than 3 members 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 three reviews by the review committee constituted by the Head of the Department. At the end of the semester examination, 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: 30 PERIODS

OUTCOMES:

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

- Formulate a real time problem, identify the requirement from effective literature survey
- Implement the technical ideas, strategies and methodologies
- Apply the new tools, algorithms, techniques that contribute to obtain the solution of the project
- Test and validate through conformance of the developed prototype
- Develop effective communication and continues learning

V.GOPE

CHAIRMAN
BoS (AGE)

20EEC601L **EMPLOYABILITY SKILLS** **L T P C**
0 0 2 1

OBJECTIVES:

The student should be made to:

- Learn the application of mathematical and project management to different contexts
- Focus on quantitative ability and employability 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 of Mixtures – Coding and 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 – Mensuration – 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 RECKONERS FOR INTERVIEWS **6**

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

Soft Skills – Types of Interview – 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

Chairman
BoS/S&H

TEXT BOOKS:

1. Aggarwal R S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing New Delhi, Revised Edition, 2017.
2. Murty G R K, "Soft Skills for Success", DGM ICFAI books, Revised Edition, 2005.

REFERENCES:

1. Abhijit Guha, "Quantitative Aptitude for All Competitive Examinations", McGraw Hill Education, Sixth Edition, 2016.
2. Carnegie Dale, "How to Win Friends and Influence People", Simon and Schuster New York, 1998.
3. Thomas A Harris, "I'm OK - You're OK", Harper and Row New York, 1972.
4. Rajesh Verma, "Fast Track Objective Arithmetic", Arihant Publications (India) Limited, 2012.
5. Arun Sharma, "How to Prepare for Quantitative Aptitude for CAT", McGraw Hill Education, Eighth Edition, 2018.

Chairman
BoS/S&H

20AG701	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the principles and basic concepts of remote sensing
- Gain knowledge on data processing and image analysis of raw satellite images
- Acquire the importance of Geographical information system for developing different maps
- Impart the skill on data input and analysis in geographical information system
- Know the applications of Remote Sensing and GIS in agriculture, soil and water resources

UNIT I CONCEPTS OF REMOTE SENSING 9

Definition – Historical background – Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors – Active and passive remote sensing interference – Atmospheric effects on remote sensing – Energy interaction with earth surface feature – Data acquisition – Reflectance, spectral signatures for water, soil and vegetation. Satellites – Types – Sun synchronous – Geo synchronous remote sensing satellites LANDSAT, SPOT & IRS – Resolution – Spectral, spatial, radiometric and Temporal resolution Recent satellites with its applications.

UNIT II DATA PRODUCTS AND IMAGE ANALYSIS 9

Data products –based on level of processing- o/p – scale – area/coverage – data availability – data ordering- data price - Image interpretation – Visual interpretation elements – interpretation key. Digital image processing – Image enhancement – image classification – Supervised and unsupervised – Vegetation Indices

UNIT III CONCEPTS OF GIS 9

Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.

UNIT IV DATA INPUT AND ANALYSIS 9

Data – Spatial, Non-Spatial – Database models – Hierarchical network, Relational and Object Oriented Data Models – Raster and Vector – Methods of Data input – Data Editing – Files and formats – Data structure – Data compression. Introduction to analysis – Measurements – Queries – Reclassification – Simple spatial analysis – Buffering – Neigh boring functions – Map overlay – Vector and raster – Spatial interpolation – Modelling in GIS – Digital Elevation Modelling – Expert systems.

V.Gopi

CHAIRMAN
BoS (AGE)

UNIT V APPLICATION OF RS AND GIS **9**

Crop Acreage estimation – Estimation of Crop Water Requirement – Crop condition – Soil mapping – classification of soil with digital numbers – soil erosion mapping- reservoir sedimentation using image processing – Inventory of water resources – water quality assessment – Application of Remote Sensing and GIS in Precision Agriculture – Monitor Crop Health - Management Decision Support Systems

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe basics of remote sensing interference and satellites
- Interpret Data products and digital image analysis for vegetation
- Assess the GIS techniques for map and their influences
- Analysis the data input, structure, Spatial interpolation and GIS modelling
- Apply GIS in land and water resource management

TEXTBOOKS:

1. Anji Reddy M, "Textbook of Remote Sensing and Geographical Information System", Atlantic Publishers and Distributors Pvt Ltd, Kindle Edition, 2018.
2. Floyd F.Sabins, "Remote Sensing: Principles and Interpretation", Waveland Pr Inc, New York, 3rd Edition, 2007.

REFERENCES:

1. Lillesand T M and Kiefer R W, "Remote Sensing and Image Interpretation", John Wiley and Sons, New York, 7th Edition, 2015.
2. Ian Heywood, "An Introduction to GIS", Pearson Education, New Delhi, 4th Edition, 2012.
3. Patel AN and Surendra Singh, "Remote sensing principles and applications", Scientific Publishers, Jodhpur, 2nd Edition, 2007.

V.GOVI

CHAIRMAN
BoS (AGE)

20AG702	RENEWABLE ENERGY IN AGRICULTURAL ENGINEERING	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the fundamentals of bio energy resources
- Understand the concepts of biogas and biocatalysis
- Acquire deep knowledge on bio reactors and fermentors
- Apply the concepts and utilization of acid hydrolysis and gasifier
- Impart applications in the biomass briquetting and environment

UNIT I BIO RESOURCE – AN INTRODUCTION **9**

Bio resource – origin – biomass types and characteristics – biomass conversion technology – Biodegradation – steps in biogas production – parameters affecting gas production – Types of biogas plants – Construction details – operation and maintenance.

UNIT II BIO ENERGY **9**

Slurry handling – enrichment and utilization – Biogas appliances – Biochemical characteristics of bio resources- Bioenergetics – Biocatalysis – Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS **9**

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors – Biological waste water treatment – Activated sludge process – Downstream processing – Recovery and purification of products.

UNIT IV ALCOHOL PRODUCTION **9**

Alcohol ethanol production – Acid hydrolysis – enzyme hydrolysis – Methanol synthesis – Antibiotics – enzymes – principles of thermochemical conversion – combustion – pyrolysis – Gasification – types of gasifiers.

UNIT V ENERGY AND ENVIRONMENT **9**

Principles of operation- chemical reaction – cleaning and cooling – Utilization- Improved wood burning stove – Energy plantations – Biomass briquetting – co generation – Impact on Environment – Bioenergy policy.

TOTAL: 45 PERIODS

V. Gopal

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know about the bioenergy resource and biomass conversion technology
- Possess the knowledge on biogas application
- Possess the knowledge on biological waste water treatment and recovery
- Describe the production process of alcohol and gasifiers
- Analysis the impact of biomass utilization and environment

TEXTBOOKS:

1. Kothari D P, Singal K C and Rakesh Rajan, "Renewable Energy Sources and Emerging Technologies" Prentice Hall India Learning Private Limited, 2nd Edition, 2011.
2. Rai G D, "Non Conventional Sources of Energy", Khanna Publishers, New Delhi, Edition 2022.

REFERENCES:

1. Chauhan D S and Srivastava S K, "Non-Conventional Energy Resources", New Age International Pvt Ltd, 4th Edition, 2022
2. David M Buchla and Thomas E Kissell, "Renewable Energy Systems" Pearson Education, New Delhi, 1st Edition, 2017.

CHAIRMAN
BoS (AGE)

20AG703L	REMOTE SENSING AND GIS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the stereoscopic vision and parallax bar
- Understand the concepts of photo and image interpretation
- Acquire the importance of Supervised and Unsupervised classification practice
- Impart the skill on data input and analysis in geographical information system
- Know the applications of GIS in agriculture, soil and water resources

LIST OF EXPERIMENTS:

1. Measurement of relief displacement using parallax bar
2. Stereoscopic vision test
3. Aerial photo interpretation - visual
4. Satellite images interpretation – visual
5. Supervised and Unsupervised classification practice
6. Database Management Systems
7. Spatial data input and editing - Digitising
8. Raster analysis problems – Database query
9. GIS application in DEM and watershed analysis
10. GIS application in rainfall-runoff modelling
11. GIS application in soil erosion modeling

TOTAL: 30 PERIODS

OUTCOME:

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

- Describe basics of relief displacement and Stereoscopic vision
- Interpret aerial photo and digital image analysis
- Assess the GIS techniques for supervised and Unsupervised classification practice
- Analysis the data input, structure and spatial interpolation
- Apply GIS in land and water resource management

TEXTBOOKS:

1. Anji Reddy M, "Textbook of Remote Sensing and Geographical Information System", Atlantic Publishers and Distributors Pvt Ltd, Kindle Edition, 2018.
2. Floyd F Sabins, "Remote Sensing: Principles and Interpretation", Waveland Pr Inc, New York, 3rd Edition, 2007.

REFERENCES:

1. Lillesand T M and Kiefer R W, "Remote Sensing and Image Interpretation", John Wiley and Sons, New York, 7th Edition, 2015.
2. Ian Heywood, "An Introduction to GIS", Pearson Education, New Delhi, 4th Edition, 2012.

V.GORE

CHAIRMAN
BoS (AGE)

20AG704L RENEWABLE ENERGY LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the Characterization of biomass
- Understand the working of biogas plant
- Acquire deep knowledge on pyrolysis process of making tar
- Impart the importance of solar energy in water heater, dryer and water pumping
- Know the working of wind energy generation and hydel power

LIST OF EXPERIMENTS:

1. Characterization of biomass – proximate analysis
2. Design of KVIC / Deenbandhu model biogas plant
3. Making of Tar under pyrolysis process
4. Study on briquetting
5. Automatic weather station – Analysis of wind data and prediction
6. Simulation study on Solar PV Energy System.
7. Experiment on VI- Characteristics and efficiency of 1kWp Solar PV System
8. Testing of solar water heater
9. Testing of solar dryer
10. Testing of solar photovoltaic water pumping system
11. Simulation study on Wind Energy Generator
12. Experiment on performance assessment of micro wind energy generator.
13. Simulation study on Hydel power.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Possess the knowledge on thermal conversion technologies of biomass
- Discuss the working of biogas plant
- Acquire the fundamental knowledge on pyrolysis process and their components
- Apply solar energy conversion system to meet the energy requirements of farms
- Analysis the energy generation from wind and hydel resource

REFERENCES:

1. Khandelwal K C and Mahdi S S "Biogas Technology: a practical handbook" Tata McGraw Hill Pub. Co. Ltd, New Delhi, 1986
2. Solanki C S "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Pvt Ltd, New Delhi, 3rd Edition, 2015.

CHAIRMAN
BoS (AGE)

20AG705L	MINI PROJECT-II	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Students should be made to:

- Acquaint with the process of identifying the needs and converting it into the problem
- Analyse the process of solving the problem as an individual or in a team
- Apply the basic engineering fundamentals to attempt solutions for the problem
- Inculcate the process of self-learning and research
- Familiarize with the project report preparation and product development

GUIDELINES FOR REVIEW AND EVALUATION

The students in convenient groups of not more than 3 members have to design and fabricate an engineering system / components. Every project work shall have a guide who is the member of the faculty of the institution.

The students are required to design and fabricate the chosen system / components in the college and demonstrate its working apart from submitting the project report which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.

At the end of the semester examination, 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: 30 PERIODS

OUTCOMES:

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

- Identify the problem specification and develop conceptual design and solution for the problem
- Build team work and responsibilities
- Develop and implement ideas to build physical model in order to meet the society, curriculum requirements and needs
- Demonstrate a wide range of skills and knowledge learned in terms of professional and ethical values of engineering problems
- Explain the project work in the form of report and oral presentation with demonstration

V.Gopi

CHAIRMAN
BoS (AGE)

20AG706L	INDUSTRIAL TRAINING (2 WEEKS DURING VI SEMESTER - SUMMER)	L T P C 0 0 0 1

OBJECTIVES:

The Students should be made to:

- Understand the field work by attaching to any industry / organization and a firsthand knowledge of practical problems in Agricultural Engineering.
- Identify the real time problem
- Gain working experience and skills in carrying out engineering tasks related to various fields of agriculture
- Understand the new tools and techniques for the problem
- Verify the results in design and experiment solutions

GUIDELINES FOR REVIEW AND EVALUATION

The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOMES:

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

- Gain working experience and skills in carrying out engineering tasks related to various fields of agriculture
- Formulate a real time problem and identify the requirement from the industry
- Implement the technical ideas, strategies and methodologies
- Apply the new tools, algorithms, techniques that contribute to obtain the better solution
- Develop effective communication and continues learning

V.GOPE

CHAIRMAN
BoS (AGE)

20AG801L **PROJECT WORK**

L	T	P	C
0	0	20	10

OBJECTIVES:

The Students should be made to:

- Solve problems identified from the literature review
- Understand research methodologies and promote research findings
- Identify the real time problems
- Design a model for solving the problems
- Develop and manufacture a new device or working model

GUIDELINES FOR REVIEW AND EVALUATION

A group of not more than 3 students works 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 a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required 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,

- Identify the specific problem and develop conceptual solution for the problem
- Develop new ideas to build physical model
- Proposing different solutions for the problem based on industry needs
- Demonstrate a working model or machine element
- Take up any challenging practical problem to find solution by formulating proper methodology

CHAIRMAN
BoS (AGE)

20AG101PE	FUNDAMENTALS OF FOOD PROCESS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the role food rheology in food materials
- Understand the effects of thermal processing in foods
- Acquire deep knowledge on drying of food materials
- Apply the concepts of size reduction and mechanical separation in food process
- Impart knowledge on importance of non-thermal processing in foods

UNIT I FOOD RHEOLOGY **9**

Rheological properties of foods – Rheology of processed foods – Rheological methods – Measurements of rheological parameters – Rheological properties of fluid foods – granular and powder foods – solid foods. Viscoelastic foods – Viscoelastic models – Measurements of food texture –Instruments for rheological measurement.

UNIT II THERMAL PROCESSING OF FOODS **9**

Thermal destruction of microbial cells and bacteria spores –Kinetics of microbial death. Mechanisms of heat transfer in foods – blanching, pasteurization and sterilization. Thermal processing equipment and technology. Evaporation and concentration – heat exchangers.

UNIT III DRYING AND FREEZING TECHNOLOGY **9**

Water activity – drying rate curve – drying time prediction. Driers – tray, tunnel, puff, fluidized bed, spray, rotary drier – Freeze drying. Freezing – effects of freezing in foods. Principles of freezing – methods of freezing and equipments. Storage of frozen and dried products.

UNIT IV SIZE REDUCTION AND MECHANICAL SEPARATION **9**

Size reduction of solids – principle and laws of size reduction. Equipments used for size reduction. Mechanical separation – filtration, sedimentation – equipments used for filtration. Mixing and Agitation.

UNIT V LEACHING, EXTRACTION AND NON-THERMAL PROCESSING **9**

Leaching – principles of leaching – methods of leaching – equipments used for leaching process. Extraction – principles of extraction – methods of extraction – equipments used for extraction. Non-thermal processing of foods –types – applications.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know about the rheology of food materials
- Possess the knowledge on thermal food processing
- Possess the knowledge on functions of dryers
- Apply suitable size reduction methods in food processing
- Acquired the knowledge on non-thermal processing of foods

TEXTBOOKS:

1. Toledo T R, Singh K R and Kong F, "Fundamentals of Food Process Engineering", Springer Pvt. Ltd, 4th Edition, 2018.
2. Akash P and Mandhyan B L, "Food Process Engineering and Technology", New India Publication, 2020.

REFERENCES:

1. McCable W L, Smith J C and Harriott P, "Unit Operations in Chemical Engineering", McGraw Hill Education India Pvt. Ltd., 7th Edition, 2017.
2. Ashim K D, Jasim A, Rao M A and Rizvi S H, "Engineering Properties of Food", CRC Press Pvt. Ltd., 4th Edition, 2014.

CHAIRMAN
BoS (AGE)

20AG102PE	FOOD AND DAIRY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Acquire knowledge about the properties and different methods of milk processing
- Introduce milk processing and manufacture of dairy products
- Impart knowledge on food and its different properties
- Understand the basic principles of food processing and food preservation techniques
- Identify the importance of packaging and quality control practices in the food industry

UNIT I PROPERTIES AND PROCESSING OF MILK 9

Dairy Industry – importance and status – Milk Types – Composition and properties of milk – Production of high quality milk – Method of raw milk procurement and preservation – Processing – Staining – Filtering and Clarification – cream separation – Pasteurization – Homogenization – sterilization, UHT processing and aseptic packaging – emulsification – Fortification.

UNIT II DAIRY PRODUCTS 9

Manufacture of Milk Powder – Processing of Milk Products – Condensed Milk – Skim milk – Butter milk – Flavoured Milk, whey, casein, yoghurt and paneer – Manufacture of Butter – Cheese Ghee, ice creams and frozen desserts – standards for milk and milk products – Packaging of Milk and Milk Products – Cleaning and Sanitation – Dairy effluent treatment and disposal.

UNIT III FOOD AND ITS PROPERTIES, REACTION AND KINETICS 9

Constituents of food – thermal processing of foods – cooking, blanching, sterilization, pasteurization, canning – Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves – water activity, sorption behaviour of foods – isotherm models – monolayer value, BET isotherms, Raoult's law, Norrish, Ross, Salwin - Slawson equations.

UNIT IV PROCESSING AND PRESERVATION OF FOODS 10

Coffee, Tea processing – Concentration of foods, freeze concentration – osmotic and reverse osmotic concentration – drying and dehydration of food – Tray, tunnel, belt, vacuum and freeze dryers – rehydration of dehydrated foods – Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine – Food preservation methods – preservation by irradiation, microwave and dielectric heating of food.

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BoS (AGE)

UNIT V PACKAGING AND QUALITY CONTROL 8

Food packaging, importance, flexible pouches – retort pouches – aseptic packaging, granules, powder and liquid packaging machines – nanotechnology – principles – applications in food processing – food plant location – Quality control of processed food products – Factors affecting quality.

TOTAL: 45 PERIODS

OUTCOME:

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

- Analyze the properties and processing of milk
- Familiar with the manufacturing and processing of dairy products
- Illustrate the thermal processing of food, reaction and kinetics
- Apply the various food processing and food preserving methods for different application
- Explain the different packing and quality control of processed food products

TEXTBOOKS:

1. Chandra Gopala Rao, "Essentials of Food Process Engineering", B.S. Publications, Hyderabad, 2006.
2. Walstra P, Jan T M Wouters and Tom J Geurts, "Dairy Science and Technology", CRC press, 2nd Edition, 2005.

REFERENCES:

1. Subbulakshmi G and Shobha A Udipi, "Food Processing and Preservation", New Age International Publications, New Delhi, 2nd Edition, 2022.
2. Toledo R T, "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 2nd edition, 2000.
3. Tufail Ahmed, "Dairy Plant Engineering and Management", Kitab Mahal Publishers, Allahabad, 2010.

V.Gopi

CHAIRMAN
BoS (AGE)

20AG103PE	PROCESS ENGINEERING OF FRUITS AND VEGETABLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about handling of food materials
- Understand the concepts of preservation and value addition of fruits and vegetables
- Acquire deep knowledge on drying and dehydration technology
- Apply the concepts and utilization of minimal processing of foods
- Impart applications of canning and bottling techniques in food industry

UNIT I HARVESTING, HANDLING AND STORAGE OF FRUITS AND VEGETABLES 9

Fruits and Vegetables: classification, nutritional profile – Harvesting of fruits and vegetables – Maturity indices – Post harvest physiology – Handling – Pre-cooling and storage – Storage under ambient condition, low temperature storage, Modified atmosphere storage – concepts and methods – gas composition – Changes during storage, Production and Utilization Scenario of fruits and vegetables in India.

UNIT II PRESERVATION OF FRUITS AND VEGETABLE BY VALUE ADDITION 9

Methods of fruit and vegetable preservation – Processing using sugar – Preparation of jam, jelly, marmalade, squash, RTS, crush, nectar, cordial, fruit bar, preserves, candies and carbonated, fruit beverages. Processing using salt – Brining – Preparation of pickles, chutney and sauces, ketchup. Machinery involved in processing of fruits and vegetables products.

UNIT III PRESERVATION BY DRYING AND DEHYDRATION 9

Drying and dehydration – Types of driers – Solar, cabinet, fluidized bed drier, spouted bed drier, heat pump drier and freeze drier – Applications – Preparation of product. Changes during drying and dehydration. Problems related to storage of dried and dehydrated products.

UNIT IV MINIMAL PROCESSING AND FERMENTATION 9

Primary processing and pack house handling of fruits and vegetables; peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables. Preservation by fermentation – wine, vinegar, cider and sauerkraut.

UNIT V CANNING AND BOTTLING 9

Canning – principles, types of cans – preparation of canned products – packing of canned products – spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.

TOTAL: 45 PERIODS

V. Gore

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know about the basic handling principles after harvesting of fruits and vegetables.
- Possess the knowledge on value addition and preservation technologies in fruits and vegetables
- Possess the knowledge on dehydration and drying of food products
- Apply minimal process technology into food industries
- Acquired the basic knowledge on canning and bottling techniques in food industry

TEXTBOOKS:

1. Norman W D, "The Technology of Food Preservation", Medtech Publishers, 3rd Edition, 2017.
2. Srivastava R P and Sanjeev kumar, "Fruit and Vegetable Preservation: Principles and Practices", CBS Publishers, 2017.

REFERENCES:

1. Tandon G L, Siddappa G S and Gridhari Lal, "Preservation of Fruits and Vegetables", Bombay Popular Prakashan Publishers, 2009.
2. NPCS Board, "Handbook of Fruits, Vegetables and Food processing with Canning and Preservation", Asia Pacific Business Press Inc., 3rd Edition, 2012.

V.GORE

CHAIRMAN
BoS (AGE)

20AG104PE	SEED PROCESSING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Explore the scope and importance of good quality seed production
- Understand the concept in Multiplication of seed and hybrid seed production techniques
- Introduce the various testing process used to find the quality of seeds
- Familiarize the planning, development and organization of seed programmes
- Impart knowledge about the seed preparation for a various horticultural crops

UNIT I SEED CHARACTERS **9**

Definition – characteristics of seed and how it differs from grain – Propagation of crop plants through true seed and vegetative means – Features of good quality seed – Importance of seed in successful crop production. Floral biology: self and cross pollination – Methods of genetic improvement of crop plants such as selection, hybridization, mutation and polyploidy – Seed legislations promulgated in India from 1966 to date and the purpose of each of these legislations.

UNIT II SEED PRODUCTION AND CERTIFICATION **9**

Multiplication of seed and seed material: systems of seed multiplication, classes of seed, multiplication models, multiplication ratio, field selection, planting ratio, isolation needs and rouging – Harvest and extraction of seed – Methods of hybrid seed production – Genetic deterioration during crop production cycles – Seed certification process: legal basis, pre-requisites for applicability, detailed description of the specific steps of the certification process (with particular emphasis on field inspection).

UNIT III SEED PROCESSING AND TESTING **9**

Components of seed processing in a broader sense – Steps in seed processing in its narrower sense: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps – Seed treatment – Seed drying – Seed sampling – Seed testing: details of specific tests conducted for different purposes (service, certification and seed law enforcement) – Standards prescribed for different crops.

UNIT IV DEVELOPING SEED PROGRAMMES **9**

Types of organizations involved in seed production (public, quasi-governmental, private and cooperative), and their objectives and features – Organizational set up of a seed company – Steps involved in planning and developing a seed programme – Seed marketing activities, and analysis of seed demand and supply – Costing and pricing strategies – Economics of production of different crop seed – Seed packaging – Opportunities for Indian seed companies to have a greater share of world seed market – Visit to seed organizations – Preparing seed projects to obtain credit – Export procedures and formalities – Seed/plant quarantine methods.

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UNIT V SEED PRODUCTION IN SPECIFIC CROPS 9

Principles and special techniques used for seed production in important horticultural crops by selecting representatives of vegetable / flower / fruit / spice / condiment / plantation crops.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the characters of genetic varieties and seed qualities
- Recognize the need for Genetic seed production and certification process
- Realize the different methods of seed processing and testing.
- Analyse the economics in seed production projects and different developing programs
- Know the special technique in horticulture seed production.

TEXTBOOKS:

1. Singh S.P, "Commercial Vegetable Seed Production", Kalyani Publishers, Chennai, 2019.
2. Agarwal R.L, "Seed Technology", Oxford IBH Publishing Co, New Delhi, 2nd Edition, 2008.

REFERENCES:

1. Subir Sen and Ghosh N, "Seed Science Technology", Ludhiana Kalyani Publishers, Chennai, 1999.
2. Dahiya B S and Rai K N, "Seed Technology", Kalyani Publishers, Chennai, 1997.
3. George and Raymond A T, "Vegetable Seed Production", Longman Orient Press, New York, 2009.

V. Gore
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BoS (AGE)

20AG105PE	STORAGE AND PACKAGING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the underlying principles of spoilage and control measures in storage
- Gain knowledge on improved modern storage methods and structures
- Know about the functions of packaging materials and bio degradable packaging materials
- Identify the different flexible, plastics containers for food packing and its material testing
- Learn about special packing techniques for various food products

UNIT I SPOILAGE AND STORAGE 9

Direct damages, indirect damages of perishable and durable commodities – control measures – factors affecting storage – types of storage – Losses in storage and estimation of losses.

UNIT II STORAGE METHODS 9

Improved storage methods for grain – modern storage structures-infestation – temperature and moisture changes in storage structures – CAP storage – CA storage of grains and perishables construction operation and maintenance of CA storage facilities.

UNIT III FUNCTIONS OF PACKAGING MATERIALS 9

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

UNIT IV FOOD PACKAGING MATERIALS AND TESTING 9

Introduction – paper and paper boards – flexible – plastics – glass containers – cans – aluminium foils – package material testing – tensile, bursting and tear strength.

UNIT V SPECIAL PACKAGING TECHNIQUES 9

Vacuum and gas packaging – aseptic packaging – retort pouching – edible film packaging – tetras packaging – antimicrobial packaging – shrink and stretch packaging.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Possess the knowledge on estimation of losses in spoilage and storage
- Understand the importance of temperature and moisture in storage facilities
- Choose the correct packaging materials for various environment conditions
- Bring out the advantages and disadvantages of different packing materials for various food products
- Classify various recent technologies available in market for packaging food products

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TEXTBOOKS:

1. Matteo Alessandro Del Nobile and Amalia Conte, "Packaging for Food Preservation", Springer, Edition 2013.
2. Paine F A and Paine H Y, "Handbook of Food Packaging", Springer; 2nd Edition, 1992.

REFERENCES:

1. Himangshu Barman, "Post Harvest Food grain storage", Agrobios (India), Jodhpur. 2008.
2. Chakaraverty A, "Post harvest technology of cereals, pulses and oilseeds", Oxford & IBH publishing, New Delhi, 3rd Edition, 2018.

V.Gore

CHAIRMAN
BoS (AGE)

20AG106PE	FOOD PROCESS EQUIPMENT AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the basics of process equipment design
- Understand the concepts of design procedure
- Acquire deep knowledge on heat exchanger
- Apply the concepts and utilization of conveying systems in agriculture processing
- Learn basics and application of CAD technologies for food processing equipments

UNIT I PROCESS EQUIPMENT DESIGN **9**

Introduction on process equipment design, principles and selection of food processing equipment. Application of design engineering for processing equipment.

UNIT II DESIGN PROCEDURE **9**

Design parameters and general design procedures, Material specification, Types of material for process equipment, Design codes, Pressure vessel design, Design of cleaners.

UNIT III HEAT EXCHANGER **9**

Design of tubular heat exchanger, shell and tube exchanger and plate heat exchanger. Problems on tubular heat exchanger, shell and tube type heat exchanger and plate heat exchanger.

UNIT IV CONVEYING SYSTEM **9**

Design of belt conveyer, screw conveyor and bucket elevator, Design of dryers. Design of milling equipment.

UNIT V CAD FOR FOOD PROCESSING EQUIPMENTS **9**

Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design for Food processing equipments.

TOTAL: 45 PERIODS

OUTCOME:

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

- Know about design of process equipments
- Possess the knowledge on design procedures
- Possess the knowledge on heat exchanger applications in food industry
- Apply suitable conveying system for agriculture processing
- Apply CAD technology into design and optimization

V. GOPE
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TEXTBOOKS:

1. George S and Athanasios E K, "Hand book of Food Processing Equipment", Springer Nature Publications, 2nd Edition, 2016.
2. Rajput R K, "Heat and Mass Transfer", S Chand Publications, 7th Edition, 2019.

REFERENCES:

1. Akash P and Mandhyan B L, "Food Process Engineering and Technology", New India Publication, 2020.
2. McCable W L, Smith J C and Harriott P, "Unit Operations in Chemical Engineering", McGraw Hill Education India Pvt. Ltd., 7th Edition, 2017.

V.Gopal
CHAIRMAN
BoS (AGE)

20AG107PE	NOVEL TECHNOLOGIES FOR FOOD PROCESSING AND SHELF LIFE EXTENSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the basic principles of food processing technology
- Impart knowledge on modern food processing technology
- Acquire a basic knowledge on storage and packing technology
- Understand the oil extraction and shelf extension concepts
- Familiarize about novel food products

UNIT I BASIC PRINCIPLES OF FOOD PROCESSING **9**

Introduction to food processing – Basic principles and methods, water activity and food stability – Preservation and quality – Structure and function relationship – Chemical changes in food during processing – Browning reactions – Protein interactions – Carbohydrate interactions.

UNIT II MODERN FOOD PROCESSING TECHNOLOGIES **9**

High pressure processing and Membrane technologies – Food irradiation – RF and Microwave heating – Super critical fluid extraction – Food extrusion technology – RTE snack foods – Textured vegetable protein – Rice and dal analogues – Hurdle technology concept – Natural antimicrobials and bacteriocin – Freeze drying.

UNIT III STORAGE AND PACKAGING TECHNOLOGY **9**

Controlled atmosphere storage of food grains – Ozone microwave treatment for disinfestations of grains – Modified atmosphere packaging – Active packaging – Edible coating of fruits and vegetables.

UNIT IV OIL EXTRACTION AND SHELF LIFE EXTENSION **9**

Extraction and processing of oil – Mechanical expellers – Solvent extraction – Refining – Hydrogenation – Winterization – Shelf life extension of oils using natural antioxidants – Concepts and Measurement of rancidity.

UNIT V NOVEL FOOD PRODUCTS **9**

Microencapsulation of bioactive – Technology of oil powder – Functional foods and Nutraceuticals – Ready-to-eat therapeutic food – Micronutrient fortified high energy bar – Gluten free bread – Carbonated cereal beverage.

TOTAL: 45 PERIODS

V.Gopi

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Gain knowledge on applications of food processing technologies
- Describe the modern food processing technologies
- Identify suitable storage and packing technology
- Apply perfect oil extraction and shelf life extension method in processing of food products
- Understand the implications of novel food products

TEXTBOOKS:

1. Avantina Sharma, "Text book of Food Science and Technology", 3rd Edition, CBS Publications, 2019.
2. Vikas Nanda and Savita Sharma, "Novel Food Processing Technologies", New India Publishing Agency, 2017.

REFERENCES:

1. Bhatia S C, "Handbook of Food Processing Technology: Vol-2", Atlantic Publisher, 2008.
2. Srilakshmi B, "Food Science", New Age International Publishers, 2018.

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BoS (AGE)

20AG201PE FARM POWER AND MACHINERY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the modern trends and design criteria for farm machinery
- Impart knowledge on machinery management
- Learn about the concept of system approach in farm machinery
- Analysis time, task and optimize mechanization
- Gain knowledge on cost analysis of machinery

UNIT I INTRODUCTION TO FARM POWER AND DESIGN CRITERIA 9

Modern trends – principles – procedures – fundamentals and economic considerations for design and development of farm power and machinery systems – Reliability criteria in design and its application. Traditional Mechanization - indigenous farm tools, animal power system and role in sustainable farming practices.

UNIT II MACHINERY MANAGEMENT 9

Maintenance and scheduling of operations – Replacement of old machines – repair and maintenance of agricultural machinery – inventory control of spare parts – work study – productivity and method study. First order Markov chains and their applications in sales forecasting and in problems of inventory control and modeling of workshop processes and quality control.

UNIT III SYSTEMS APPROACH 9

System approach in farm machinery management and application of programming techniques to the problems of farm power and machinery selection.

UNIT IV PLANNING OF MACHINERY 9

Time and motion study. Man-machine task system in farm operations – planning of work system in agriculture. Computer application in selection of power units and to optimize mechanization system.

UNIT V ECONOMIC ANALYSIS 9

Energy conservation – performance and power analysis – cost analysis of machinery – fixed cost and variable costs – effect of inflation on cost, selection of optimum machinery and replacement criteria – Break-even analysis – reliability – cash flow problems and mechanization planning.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Study about design and development of farm power and machinery systems
- Discuss the machinery management and inventory control
- Analysis system approach in farm machinery with programming techniques
- Understand the planning of farm machinery
- Evaluate the economic analysis in farm machinery

TEXT BOOKS

1. Bainer R, Kepner R A and Barger E L, "Principles of Farm Machinery", John Wiley and Sons, New York, 3rd Edition, 2005.
2. Smith H P, "Farm Machinery and Equipment", Read Book Publishers, New Delhi, Illustrated edition, 2010.

REFERENCES:

1. Donnell Hunt and David Wilson, "Farm Power and Machinery Management", Waveland Pr. Inc., 11th Edition, 2015.
2. Sharma D N and Mukesh S, "Farm Power and Machinery Management", Jain Brothers, 2nd Edition, 2021.

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BoS (AGE)

20AG202PE	FARM ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Recognize the concepts of combustion in Spark Ignition engines
- Know the basic principle and stages of combustion in Compression Ignition engines
- Provide knowledge on emission formation, control and measurement
- Learn about various alternate fuels and its properties
- Explore the principles of recent trends in engines

UNIT I SPARK IGNITION ENGINES **9**

Air-fuel ratio requirements – stages of combustion – normal and abnormal combustion – factors affecting knock – fuel injection systems – mono point, multipoint and direct injection combustion chambers – effects of compression ratio.

UNIT II COMPRESSION IGNITION ENGINES **9**

Stages of combustion – normal and abnormal combustion – factors affecting knock – direct and indirect injection systems – air motion – swirl measurement – combustion chambers – fuel spray behaviour – spray structure and spray penetration – turbo charging.

UNIT III EMISSION FORMATION AND CONTROL **9**

Formation of NO_X, HC and CO mechanism – smoke and particulate emissions – green house effect – methods of controlling emissions – three way catalytic converter – particulate trap – emission measuring equipment – smoke and particulate measurement – emission norms – national and international emission standards.

UNIT IV ALTERNATE FUELS **9**

Need for alternate fuels – alcohols, vegetable oils, bio-diesel, bio-gas, natural gas, liquefied petroleum gas and hydrogen – properties and manufacturing– engine modifications required– performance, combustion and emission characteristics of engines for alternate fuels.

UNIT V RECENT TRENDS AND TRACTOR REGULATION **9**

Homogeneous charge compression ignition engine – lean burn engine – stratified charge engine – surface ignition engine – electronic engine management – common rail direct injection diesel engine – gasoline direct injection engine – hybrid electric vehicles. Tractor regulation – Norms

TOTAL: 45 PERIODS

V. Gopi

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Understand the principle of combustion process in Spark Ignition engines
- Recognize the principle of combustion process in Compression Ignition engines
- Gain knowledge on emission formation, controlling and measuring technique
- Identify possible alternate fuels for internal combustion engines
- Familiarize with the recent developments in engine and tractor regulation

TEXTBOOKS:

1. Ganesan V, "Internal Combustion Engines", Tata McGraw-Hill, 4th Edition, 2012.
2. John B Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill, 2nd Edition, 2018.

REFERENCES:

1. Ramalingam K K, "Internal Combustion Engine Fundamentals", Scitech Publications, 3rd Edition, 2018.
2. Richard Stone, "Introduction to Internal Combustion Engines", Palgrave Macmillan Limited, New Edition, 2012.
3. Gupta H N, "Fundamentals of Internal Combustion Engines", Prentice Hall of India, 2006.

V.GOPAL

CHAIRMAN
BoS (AGE)

20AG203PE	FARM STRUCTURES AND GREEN HOUSE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart knowledge on the various components of a farmstead and grain storage
- Acquire basic knowledge on the various animal housing
- Familiarize in feed storage and machinery shed structures
- Illustrate design and construction of rural road, water supply and sewage disposal structures
- Acquire knowledge on green house structures

UNIT I FARMSTEAD PLANNING AND GRAIN STORAGE 9

Different types of farm buildings – farm site selection – building arrangement – indigenous food grain storage structures – need for good storage – modern grain storage and concrete bins – threshing and drying floors.

UNIT II HOUSING OF DAIRY CATTLE AND POULTRY 9

Planning and designing dairy barns – stall barns and loose houses – milking parlor – waste management – poultry housing requirements – common types of poultry houses and their planning – introduction to aquacultural systems.

UNIT III FARM FEED STORAGE STRUCTURES AND MACHINERY SHED 9

Silo-requirement – Types of silo, over ground, underground and others – Design of silos – covered an open spaces – Machinery sheds – Site selection – Types and shapes of building – Space requirements – Farm shops, building requirement and space requirement – Fencing, types of fences – fence posts.

UNIT IV RURAL ROADS, FARM WATER SUPPLY AND SEWAGE DISPOSAL 9

Survey and planning – Geometrical design – Pavement design – Construction and maintenance – Typical rural culverts of different sizes, their hydraulic and structural design and construction – Sources of water supply – Estimation of quantity for different consumption – Capacity requirements of storage tanks – distribution systems – Design of septic tanks and sanitary structures.

UNIT V GREEN HOUSES 9

Types – Functional design – Structural material and design – Orientation, ventilation, cooling and types of cladding material Type design – Water management in green houses.

TOTAL: 45 PERIODS

V. GOPE

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Describe various farmstead and determine suitable site for their construction
- Design the poultry house, dairy barn and aquaculture systems
- Design the different types of farm feed and storage structures
- Design the roads, water supply system and septic tanks in rural
- Apply the knowledge on design of green house structures

TEXT BOOKS:

1. Ojha T P and Michael A M, "Principles of Agricultural Engineering, Vol.- I, 12th Edition", Jain Brothers, New Delhi. 2016.
2. Van Lier H V, "CIGR Handbook of Agricultural Engineering, Vol. I - Land and Water Management Engineering", ASAE, USA, 1999.

REFERENCES:

1. Bartali E H and Frederick W, "CIGR Handbook of Agricultural Engineering, Vol. II Animal Production and Aquacultural Engineering", ASAE, USA, 1999.
2. Raghupathi M, "Design of Steel Structures", Tata McGraw Hill Pub. Com. New Delhi, 2005
3. Punmia B C, "Reinforced Concrete Structures – Vol. I" Laxmi publications, New Delhi, 2005.

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BoS (AGE)

20AG204PE	SPECIAL FARM EQUIPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart knowledge on farm equipments
- Learn in detail about the application of sprayers and dusters
- Gain knowledge on working principle of harvesting equipments.
- Acquire knowledge of the construction and working of threshers and other machineries
- Understand the working principle of specialized farm equipments

UNIT I MOWERSAND WEEDING EQUIPMENT **9**

Weeding and intercultural equipment – Junior hoe guntaka – blade harrow – rotary weeders for upland and low land – selection, constructional features and adjustments – Spading machine – coir pith applicators – Mower mechanism – lawn mowers.

UNIT II SPRAYERS AND DUSTERS **9**

Sprayers – Sprayer operation – boom sprayer – precaution – coverage – factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) – Electrostatic sprayers – Aerial spraying – Air assist sprayer – sorchard sprayers – Dusters – types – mist blower cum duster– other plant protection devices, care and maintenance.

UNIT III THRESHERS AND HARVESTERS **9**

Construction and adjustments – registration and alignment. Windrowers, reapers, reaper binders and forage harvesters. Diggers for potato, groundnut and other tubers. Sugarcane harvester's cotton pickers – corn harvesters – fruit crop harvesters – vegetable harvesters.

UNIT IV THRESHERS AND OTHER MACHINERIES **9**

Thresher – construction and working of multi crop thresher. Forest machinery– shrub cutters– tree cutting machines – post hole diggers – Chaff cutter – flail mowers – lawn mowers – tree pruners.

UNIT V SPECIALIZED FARM EQUIPMENT **9**

Pneumatic planters – air seeders – improved ploughs – reversible ploughs – suction traps – seed and fertilizer broadcasting devices, manure spreaders, sweep weeders – direct paddy seeders, direct paddy cum daincha seeder, coconut tree climbing devices, tractor operated hoist, tractor operated rhizome planter – Transplanters and Balers.

TOTAL: 45 PERIODS

V.Gopal

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Gain knowledge on the weeding and intercultural equipments
- Calculate the particle size and area covered by different sprayers
- Select suitable harvesting equipments in the agriculture field operations
- Use fruit pluckers, tree shakers, post hole diggers and chaff cutter
- Operate special farm equipment in all field operations

TEXTBOOKS:

1. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publishers Distributors, Delhi, 2020.
2. Michael and Ojha, "Principles of Agricultural Engineering", Volume - 1, Jain Brothers publications, 14th Edition, New Delhi, 2021.

REFERENCES:

1. Kepner R A, "Principles of farm machinery", CBS Publishers and Distributers, Delhi, 3rd Edition, 2005.
2. Srivastava A C, "Elements of Farm Machinery", Oxford and IBH Publishing Co, New Delhi, 1991.

CHAIRMAN
BoS (AGE)

20AG205PE	TESTING AND EVALUATION OF FARM MACHINERY AND EQUIPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Learn out testing of tractors and its performance
- Understand the concepts of testing of tillage and sowing equipment
- Acquire deep knowledge on weeders, sprayers and dusters
- Apply the concepts of testing of Combine harvester
- Impart applications in the safety testing of agricultural machinery

UNIT I TESTING AND EVALUATION OF AGRICULTURAL TRACTORS 9

Testing and evaluation system in India – Agricultural machinery situation – Mechanization policy – future prospects – standardization efforts – type of testing systems – General regulations – terminology – basic measurements, speed, fuel consumption, smoke density and power measurement – test items, specifications checking – PTO performance test – engine test, drawbar performance test – field test procedures – interpretation of results - Power tillers testing. Test code for tractor.

UNIT II TESTING AND EVALUATION OF TILLAGE AND SOWING EQUIPMENTS 9

Testing of tillage machinery – laboratory test (hardness testing, chemical analysis) – field test (rate of work, quality of work, draft measurement, fuel consumption) – seed drill – laboratory test (seed drill calibration) – field checking and field tests. Test code for tillage and sowing equipments.

UNIT III TESTING AND EVALUATION OF INTERCULTURAL EQUIPMENTS 9

Testing and evaluation of weeders – types of tests for weeder – types of pesticide application equipment – terminology – types of tests for sprayers – testing methods – types of test for duster – testing methods. Test code for intercultural equipments.

UNIT IV TESTING AND EVALUATION OF HARVESTING EQUIPMENTS 9

Types of grain combines – combine systems – test items – procedure for laboratory testing – materials for field test – observations during field tests – sample analysis – data analysis – summary of performance parameters – analysis of field test data. Test code for harvesting equipments.

UNIT V SAFETY TESTING OF AGRICULTURAL MACHINERY 9

Types of agricultural machinery accidents – causes of agricultural machinery accidents – technical measurements for ensuring safety – methods of safety testing – ROPS and FOPS – safety precautions.

TOTAL: 45 PERIODS

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BoS (AGE)

OUTCOME:

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

- Understand the basics of testing procedures and standards of tractor testing
- Acquire Knowledge on testing of tillage, sowing equipment
- Learn about the intercultural equipments
- Possess the knowledge on harvesting equipment
- Know about the safety standards and testing procedures

TEXTBOOKS:

1. Metha M L, Verma S R, Mishra S K and Sharma V K, "Testing and Evaluation of Agricultural Machinery", Daya Publishing House, India, 2016.
2. Indian Standards Test Codes related to tractors, power tillers and agricultural implements.

REFERENCES:

1. Anonymous. 1983. RNAM Test Codes & Procedures for Farm Machinery. Technical Series 12.
2. Nebraska Tractor Test Codes for Testing Tractors, Nebraska, USA.

V.GORE

CHAIRMAN
BoS (AGE)

20AG206PE	HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the concept of ergonomics in agriculture
- Know the effect of visual, auditory and factual displays in human performance
- Acquire deep knowledge on energy expenditure of farm machineries
- Possess the knowledge on anthropometry
- Learn about the safety features and regulation acts in farm machinery

UNIT I ERGONOMICS **9**

Ergonomics – introduction – Role of ergonomics in Agriculture – Human metabolism – energy liberation in human body – Types of human metabolism – energy requirements at work – acceptable work load.

UNIT II PHYSIOLOGICAL FUNCTIONS **9**

Human Skeletal system – muscle, structure and function – Physiological stress – Efficiency of work – Physical functions – Age and individual differences in physical functions – Physiological and operational criteria of physical activity.

UNIT III ENERGY EXPENDITURE **9**

Energy expenditure of activities-keeping energy expenditure within bounds – Energy expenditure of Spraying – Weeding operations – Movements of body members – Strength and endurance of movements – Movement of body members related to Agricultural activities – Speed and accuracy of movements – Time and distance of movements - Reaction time.

UNIT IV ANTHROPOMETRY **9**

Anthropometry – introduction- Types of data- Principles of applied anthrophometry – concept of percentile – Normal distribution – Estimating the range – Minimum and Maximum dimensions Cost benefit analysis – applications of anthropometric data. Anthropometric consideration in tool / equipment design.

UNIT V HUMAN SAFETY **9**

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Understand the importance of ergonomics in agriculture
- Know the effect of visual, auditory and factual displays in human performance
- Possess the knowledge on energy expenditure of farm machineries
- Design the work space in accordance to anthropometry
- Understand the general safety features and regulation acts in farm machinery

TEXTBOOKS:

1. Mark S.Sanders, Ernest J. McCormick, "Human Factors in Engineering and Design", Mc Graw Hill Education, New York, 1992.
2. Murrel K F H, "Ergonomics, Man in his working environment", Springer, London, 2012.

REFERENCES:

1. Etienne Grandjean, "Fitting the task to the man", Taylor and Francis", London, 1988.
2. John B. Liljedahl, Paul K. Turnquist, David W. Smith, Makoto Hoki, "Tractors and their power units", John Wiley and sons, London, 2012.

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BoS (AGE)

20AG207PE	AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart the fundamental knowledge and basic concepts of economics and farm management
- Understand the laws for economics and cost concepts analysis in agriculture sector
- Farm financial cost curve analysis, optimum input and output level analysis for farms
- Explore the management of the land, labour and machinery resources
- Know about the farm budgeting and financial analysis

UNIT I FARM MANAGEMENT 9

Agricultural Economics – definition and scope – Farm Management – definition – scope – Classification of farms – Basic concepts in farm management – Relationship between farm management and other basic sciences – Farm layout – Farm records and accounts – Farm appraisal techniques – Valuation .

UNIT II LAWS OF ECONOMICS 9

Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns – Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies – Cost concepts – types – Opportunity cost – comparison of costs – Factor relationship – concepts.

UNIT III COST CURVES 9

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs – Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves –Optimum input and output levels – Factor – factor relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops – Preparation of interview schedule and farm visit for data collection.

UNIT IV MANAGEMENT OF RESOURCES 9

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources – land, labour, capital and measurement of their efficiencies – Mobilization of farm resources – Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.

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UNIT V FARM MANAGEMENT AND FINANCIAL ANALYSIS 9

Farm management – need and analysis – Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles – Farm planning – Elements of farm planning – Whole farm planning and partial planning – Farm level management system – Farm budgeting: whole farm budgeting and partial budgeting – Estimation of credit – examples of farm planning and budgeting.

TOTAL: 45 PERIODS

OUTCOME:

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

- Plan the financial aspects related to farm management in a cost effective manner
- Understand the demand and supply concepts in economics
- Compare the cost of cultivation, cost of production and their efficiency
- Examine and evaluate the risk and uncertainty involved in management of farm resources
- Gain knowledge on elements of farm management system and financial analysis

TEXTBOOKS:

1. Johl S S and Kapur T R, "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2017.
2. Subba Reddy S, Raghu Ram P, Neelakanta Sastry T V and Bhavani DeviI, "Agricultural Economics", Oxford and IBH Publishing Co Pvt Ltd, New Delhi, 2016.

REFERENCES:

1. Raju V T, "Essentials of Farm Management", Oxford and IBH Publishing Co Pvt Ltd, New Delhi, 2002.
2. Subba Reddy Sand Raghu Ram P, "Agricultural Finance and Management", Oxford and IBH Publishing Co Pvt Ltd., New Delhi, 2018.
3. Muniraj R, "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt Ltd, New Delhi, 2000.

V. Gopi

CHAIRMAN
BoS (AGE)

20AG302PE	HYDROLOGY AND WATER RESOURCES ENGINEERING	L T P C 3 0 0 3

OBJECTIVE:

The student should be made to:

- Acquire knowledge on hydrologic cycle and evaporation
- Gain basic knowledge on runoff, flow measurements and hydrographs
- Exposure on flood and drought analysis
- Illustrate the classification of reservoirs and deep learning on principles, design of reservoirs
- Understand the importance of groundwater and its management

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH.

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

V.GOPE

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BoS (AGE)

OUTCOMES:

After successful completion of this course students are expected to be able to:

- Understand of the key drivers on water resources, hydrological processes and their integrated behavior in catchments
- Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph
- Explain the concept of hydrological extremes such as flood and drought and management strategies
- Ability to conduct spatial analysis of rainfall data and design water storage reservoirs
- Elaborate the concept and methods of ground water management

TEXTBOOKS:

1. Subramanya K, "Engineering Hydrology", Tata McGraw Hill Education, 4th Edition, 2017.
2. Linsley R K, Freyberg D L and Franzini J B, "Water Resources Engineering", McGraw Hill International Book Company, 4th Edition, 1995.

REFERENCES:

1. Jaya Rami Reddy P, "A Textbook of Hydrology", Laxmi Publications, 3rd Edition, 2016.
2. David Keith Todd and Mays L W, "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
3. Ven Te Chow, Maidment D R and Mays L W, "Applied Hydrology", McGraw Hill Education, 1st Edition, 2017.

CHAIRMAN
BoS (AGE)

20AG301PE **CLIMATE CHANGE AND ADAPTATION FOR AGRICULTURE** **L T P C 3 0 0 3**

OBJECTIVE:

The student should be made to:

- Know about the basics and importance of the earth climate system
- Illustrate the composition and components of atmosphere
- Understand the concept of climate change and its impacts
- Learn the concept of climate change and carbon credits
- Impart knowledge on mitigation measures of climate change

UNIT I EARTH'S CLIMATE SYSTEM **9**

Role of ozone in environment – ozone layer – ozone depleting gases – Green House Effect, Radiative effects of Greenhouse Gases – Hydrological Cycle – Green House Gases and Global Warming – Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS **9**

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere – Vertical structure of the atmosphere – Composition of the atmosphere – Atmospheric stability – Temperature profile of the atmosphere – Lapse rates – Temperature inversion – effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE **9**

Causes of Climate change: Change of Temperature in the environment – Melting of ice Pole –sea level rise – Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV OBSERVED CHANGES AND ITS CAUSES **9**

Climate change and Carbon credits – CDM – Initiatives in India – Kyoto Protocol Intergovernmental Panel on Climate change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES **9**

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry – Carbon sequestration – Carbon capture and storage (CCS) – Waste (MSW) & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

TOTAL: 45 PERIODS

V. Gopi

CHAIRMAN
BoS (AGE)

OUTCOMES:

After successful completion of this course students are expected to be able to:

- Assess the greenhouse effect and climate change
- Explore the phenomena of temperature profile and pollution dispersion pattern
- Apply the impact analysis in agriculture, forestry and ecosystem
- Explore the clean development mechanism
- Discuss the alternate energy sources and mitigation effects

TEXTBOOK:

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd., 2007.
2. Jan C. van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

REFERENCES:

1. Watson R T, Zinyowera MC and Moss R H, "Climate Change 1995: Impacts, Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. Wallace J M and Hobbs P V, "Atmospheric Science: An Introductory Survey", Elsevier / Academic Press, 2nd Edition, 2006.

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BoS (AGE)

20AG305PE	ON FARM WATER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Sensitize in irrigation channel design
- Acquire a basic knowledge about command area
- Understand the importants of conjunctive use in surface and groundwater systems
- Expose to water balance techniques
- Impart the knowledge on different aspects related to water management

UNIT I DESIGN OF IRRIGATION CHANNELS **9**

Design of Erodible and Non-Erodible, Alluvial channels – Kennedy's and Lacey's Theories– Materials for Lining watercourses and field channel – Water control and Diversion structure –Design – Land grading–Land Leveling methods.

UNIT II COMMAND AREA **9**

Command area – Concept – CADA Programmes in Tamil Nadu – Duty of water – expression –relationship between duty and delta – Warabandhi – water distribution and Rotational Irrigation System – case studies.

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER **9**

Availability of water – Rainfall, canal supply and groundwater – Irrigation demand – water requirement and utilization – Prediction of over and underutilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix.

UNIT IV WATER BALANCE **9**

Groundwater balance model – Weekly water balance – Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency.

UNIT V SPECIAL TOPICS **9**

National water policy – Institutional aspects – Socio-economic perspective – Reclamation of salt affected soils – Seepage loss in command area– Irrigation conflicts – Water productivity – Water pricing.

TOTAL: 45 PERIODS

V. Gopi

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BoS (AGE)

OUTCOMES:

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

- Design the irrigation channels
- Understand the role and importance of command area activities
- Apply conjunctive technique in surface and groundwater irrigation system
- Identify suitable method for maintaining water balance levels
- Describe the important concepts related on farm water management

TEXTBOOK:

1. Michael A M, "Irrigation Theory and practice", Vikas publishing house, New Delhi, 2006.
2. Michael A M and Ojha T P, "Principles of Agricultural Engineering Vol II", Jain Brothers, New Delhi, 2002.
3. Suresh R, "Land and Water Management Principles", Standard Publishers and Distributors, New Delhi, 2008.

REFERENCES:

1. Keller J and Bliesner D Ron, "Sprinkler and Trickle irrigation", The Blackburn Press, Annotated Edition, 2001.
2. Israelson, "Irrigation principles and practices", John Wiley & Sons, New York, 2002.
3. Modi P N, "Irrigation Water Resources and Water Power Engineering", Standard Book House, New Delhi, 11th Edition, 2019.

CHAIRMAN
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20AG304PE	WATERSHED MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Acquire a basic knowledge about the water shed management practices
- Impart knowledge on watershed planning
- Familiarize on watershed management techniques
- Learn about water conservation techniques
- Acquire knowledge on watershed development programme

UNIT I INTRODUCTION TO WATERSHED MANAGEMENT 9

Watershed – Definition – concept – Objectives – Land capability classification – priority watersheds – land resource regions in India.

UNIT II WATERSHED PLANNING 9

Planning principles – collection of data – present land use – Preparation of watershed development plan – Estimation of costs and benefits – Financial plan – selection of implementation agency – Monitoring and evaluation system.

UNIT III WATERSHED MANAGEMENT 9

Participatory watershed Management – run off management - Factors affecting runoff – Temporary & Permanent gully control measures – Water conservation practices in irrigated lands – Soil and moisture conservation practices in dry lands.

UNIT IV WATER CONSERVATION PRACTICES 9

In-situ & Ex-situ moisture conservation principle and practices – Afforestation principle – Micro catchment water harvesting – Ground water recharge – percolation ponds – Water harvesting – Farm pond – Supplemental irrigation – Evaporation suppression – Seepage reduction.

UNIT V WATERSHED DEVELOPMENT PROGRAMME 9

River Valley Project (RVP) – Hill Area Development Programme (HADP) – National Watershed Development Programme for Rainfed Agriculture (NWDPRA) – Other similar projects operated in India – Govt. of India guidelines on watershed development programme – Watershed based rural development – infrastructure development – Use of Aerial photography and remote sensing in watershed management – Role of NGOs in watershed development.

TOTAL: 45 PERIODS

V. Gopal

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BoS (AGE)

OUTCOMES:

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

- Gain knowledge on basics of watershed management
- Illustrate the different types of watershed planning
- Understand the watershed management concepts
- Discuss water conservation technologies
- Evaluate watershed Development programmes

TEXT BOOKS:

1. Suresh R, "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi, 2005.
2. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
3. Murthy V V N, "Land and water management", Kalyani publishing, New Delhi, 2005.

REFERENCES:

1. Gurmel Singh, "Manual of Soil and Water Conservation Practices", Oxford & IBH publishing Co New Delhi, 2004.
2. Suresh R, "Land and Water Management Principles", Standard Publishers and Distributors, New Delhi, 2008.
3. Tripathi R P and Singh H P, "Soil Erosion and Conservation", Willey Eastern Ltd., New Delhi, 2002.

V.GORE

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BoS (AGE)

20AG303PE	NATURAL RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the fundamentals of sustainable natural resources
- Understand the concepts of Participatory Rural Appraisal for integrated natural resources management
- Acquire deep knowledge on environmental impact assessment and Indian policies
- Impart applications of remote sensing and GIS for crop and soil condition monitoring
- Understand the importance of climate change and vulnerability analyse

UNIT I INTRODUCTION TO NATURAL RESOURCES 9

Concept of resource, carrying capacity, ecological foot print and sustainability: sustainable portfolios, building sustainable business, natural resources of different geographical regions.

UNIT II INTEGRATED NATURAL RESOURCES MANAGEMENT 9

Integrated natural resources management such as land, water, forest – need to sustain agriculture productivity. Participatory Rural Appraisal – ranking technique – water shed management – National Water Policy.

UNIT III ENVIRONMENT IMPACT ASSESSMENT 9

The need for EIA – Indian policies – EIA method – EIA process and project cycle - environmental laws and protection acts.

UNIT IV REMOTE SENSING AND GIS FOR AGRICULTURE 9

Agriculture land monitoring – land use land cover mapping – crop condition monitoring – crop pest/ disease detection – crop system analysis – soil moisture status monitoring – water resources command area management.

UNIT V CLIMATE CHANGE 9

Basic concepts - drivers of climate change – stake holders – GO's - NGO's risk assessment – Risk management – vulnerability assessment – vulnerability indicators.

TOTAL: 45 PERIODS

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BoS (AGE)

OUTCOME:

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

- Know about the fundamentals of sustainable natural resources
- Possess the knowledge on participatory Rural Appraisal for integrated natural resources management
- Analyse the suitable tool for environmental impact assessment and Indian policies
- Apply the technique in remote sensing and GIS for crop and soil condition monitor
- Acquire the knowledge on impact of climate change and vulnerability

TEXTBOOKS:

1. Brantely Kelley, "Natural resources management for a sustainable future" Larsen and Keller education June 2019.
2. Jaswant Singh and Girish Pandey, "Natural Resources Management and Conservation", Kalyani Publishers, 2015.

REFERENCES:

1. Lenka S, Lenka N K, Kundu S and Subba Rao A, "Climate Change and Natural Resources Management", Nipa Publishers, 2013.
2. Mukesh K S and Pant R M, "Natural Resource Management: Policy, Environment and Technological options", Lakshi Publishers and Distributors, 2021.

V.GORE

CHAIRMAN
BoS (AGE)

20AG306PE	MICRO IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand about the importance of micro irrigation
- Study the various types of water lifts and pump
- Learn the drip irrigation system and emitters
- Illustrate the importance of sprinkler irrigation system
- Understand the automation and solar PV system in irrigation system

UNIT I BASIC PRINCIPLES OF MICRO IRRIGATION 9

Micro-Irrigation: Introduction and scope and importance – Soil water concept – Soil water constants and infiltration – Evapotranspiration – Crop co-efficients and crop water requirement – Application of fluid mechanics in micro irrigation – Irrigation scheduling – Irrigation efficiency.

UNIT II WATER LIFTS AND PUMPS 9

Introduction to water lifts and pumps – Variable displacement pumps – Centrifugal pump – Submersible pump – Vertical Turbine pumps mixed flow – Jet and Airlift pumps – Pump selection and installation – Pump troubles and Remedies.

UNIT III DRIP IRRIGATION SYSTEM 9

Micro Irrigation system: concept and types – Drip irrigation: Introduction and its types – Design consideration and layout of drip irrigation system – Types and selection of emitters – Soil water movement in emitters – development of drip emitter. Hydraulic drip irrigation. Fertigation – Installation and Operation of drip irrigation system – Maintenance of drip irrigation system –

UNIT IV SPRINKLER IRRIGATION SYSTEM 9

Introduction to micro sprinkler and bubbler irrigation system – Design, performance evaluation, Layout, Installation, Operation and Maintenance of Sprinkler irrigation system – Standards and Quality Assurance of Sprinkler Irrigation Systems.

UNIT V MODERN PRACTICES IN MICRO IRRIGATION SYSTEM 9

Automation of Micro irrigation system – Solar PV System of Irrigation – Role of micro irrigation in precision agriculture – Economic analysis of Micro irrigation system.

TOTAL: 45 PERIODS

V.Gopi

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BoS (AGE)

OUTCOMES:

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

- Elaborate the soil water concepts and miro irrigation system
- Select suitable water lifts and pumps based on different irrigation
- Apply the analytical skills on design and operation of drip irrigation system
- Gain knowledge on design, layout and operation of sprinkler irrigation system
- Explore the modern practices in micro irrigation system

TEXTBOOKS:

1. Suresh R, "Principles of Micro-Irrigation Engineering", Standard Publishers Distributors, New Delhi, 2010.
2. Michael AM, "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2002.

REFERENCES:

1. Modi P N, and Seth S M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2017.
2. Sivanappan R K, "Sprinkler Irrigation", Oxford and IBH Publishing Co, New Delhi, 1987.

V.GOPE
CHAIRMAN
BoS (AGE)

20AG307PE	PROTECTED CULTIVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart knowledge on the basic structures on protected cultivation
- Learn on Hi-tech production technology on vegetables crops under protected cultivation
- Gain knowledge on Hi-tech production technology on flower crops under protected cultivation
- Illustrate the importance of software and sensors in precision farming techniques
- Familiarize on role of precision farming techniques in horticultural crops

UNIT I PROTECTED CULTIVATION AND ITS TYPES 9

Importance and methods of protected culture in horticultural crops – Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house – study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS 9

Protected cultivation technology for vegetable crops – Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS 9

Protected cultivation technology for flower crops – Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliage's and fillers – integrated pest and disease management – postharvest handling.

UNIT IV PRECISION FARMING TECHNIQUES 9

Concept and introduction of precision horticulture – Importance, definition, principles and concepts – Role of GIS and GPS – Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation in horticultural crops – role of computers in developing comprehensive systems needed in site specific management (SSM) –georeferencing and photometric correction – Sensors for information gathering – geostatistics – robotics in horticulture – postharvest process management (PPM) – remote sensing – information and data management and crop growth models – GIS based modeling.

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BoS (AGE)

UNIT V PRECISION FARMING OF HORTICULTURAL CROPS 9

Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the importance and types of protected cultivation
- Describe the production of vegetable crops under protected structure
- Implement the protected cultivation techniques on production of flower crops
- Apply precision farming techniques on protected cultivation of crops
- Adopt the precision farming techniques on horticultural crops

TEXTBOOKS:

1. Balraj Singh, "Protected cultivation of vegetable crops", Kalyani Publishers, Ludhiana, 2000.
2. Brahma Singh, "Advances in Protected Cultivation", New India Publishing Agency, New Delhi, 2014

REFERENCES:

1. Reddy P Parvatha, "Sustainable crop protection under Protected Cultivation" Springer Publications, USA, 2011.
2. Jitendra Singh, "Precision Farming in Horticulture" New India Publishing Agency, New Delhi, 2015.

V.Gopè

CHAIRMAN
BoS (AGE)

20AG401PE	SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURE ENGINEERING	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the basic concepts of system engineering and water resources
- Provide knowledge about linear and dynamic programming
- Impart knowledge on basic principle and concept of simulation and irrigation schedule
- Acquire knowledge on in architecture and modelling of neutral networks
- Learn about concepts and properties of fuzzy logic and genetic algorithm

UNIT I SYSTEM CONCEPTS **9**

Definition, classification, and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.

UNIT II LINEAR PROGRAMMING & DYNAMIC PROGRAMMING **9**

Introduction to operations research – Linear programming, problem formulation, graphical solution, solution by simplex method – Sensitivity analysis – application – Bellman's optimality criteria, problem formulation and solutions – application.

UNIT III SIMULATION **9**

Basic principles and concepts – Random variate and random process – Monte Carlo techniques – Model development – Inputs and outputs – Deterministic and stochastic simulation – Irrigation Scheduling – application.

UNIT IV NEURAL NETWORKS **9**

Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, various learning techniques, perception and convergence rule, Auto - associative and hetro – associative memory – Architecture: model, solution, single layer and multilayer perception model, back propagation learning methods, applications.

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM **9**

Basic concepts of fuzzy logic, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic, Fuzzy implications and Fuzzy algorithms, Fuzzy Controller, Industrial applications. Genetic Algorithm (GA) – Basic concepts, working principle, procedures, flow chart, Genetic representations, encoding, Initialization and selection, Genetic operators, Mutation – applications.

TOTAL: 45 PERIODS

V.Gope

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know the scope and importance of system engineering
- Apply linear and dynamic programme techniques in agriculture operations
- Apply the simulation techniques in irrigation scheduling and agriculture systems
- Understand the impact of neural networks in agriculture engineering systems
- Execute fuzzy logic and genetic algorithm in agriculture systems

TEXTBOOKS:

1. Vedula S and Majumdar P P, "Water Resources Systems – Modelling Techniques and Analysis", Tata McGraw Hill, New Delhi, 5th reprint, 2010.
2. Rajsekaran S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, Kindle Edition, 2013.

REFERENCES:

1. Chaturvedi M C, "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1998.
2. Taha H A, "Operations Research: An Introduction", Pearson Publication, India, 10th Edition, 2016.
3. Robert M Peart and David Shoup W, "Agricultural Systems Management – Optimizing efficiency and performance", CRC Press, 2013.

CHAIRMAN
BoS (AGE)

20AG402PE	IT IN AGRICULTURE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the precision farming with various sensors
- Gain intensive knowledge of environmental control systems
- Acquire knowledge on agricultural systems management and optimization
- Illustrate the importance of seasonal climate forecasting
- Expose the knowledge on E - Commerce systems in agriculture

UNIT I PRECISION FARMING **9**

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II ENVIRONMENT CONTROL SYSTEMS **9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT **9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

UNIT IV WEATHER PREDICTION MODELS **9**

Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

UNIT V E – GOVERNANCE IN AGRICULTURAL SYSTEMS **9**

Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.

TOTAL: 45 PERIODS

V. GOPE

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Understand the importance of IT applications in precision farming
- Explain the various environment control system for agriculture production
- Apply IT applications in agriculture systems for sustainable agriculture production
- Get familiar in weather prediction models
- Implement the E-Governance systems in agricultural marketing and technology transfer

TEXTBOOKS:

1. National Research Council and Board on Agriculture, "Precision Agriculture in the 21st Century: Geospatial and Information Technologies in Crop Management", National Academies Press, Canada, 1997.
2. Krug H and Liebig H P, "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", ISHS Acta Horticulturae 248, 1989.

REFERENCES:

1. Peart R M and Shoup W D, "Agricultural Systems Management", Marcel Dekker, New York, 2004.
2. Hammer G L, Nicholls N and Mitchell C, "Applications of Seasonal Climate", Springer, Germany, 2000.

V. Gore

CHAIRMAN
BoS (AGE)

20AG403PE	AUTOMATION IN IRRIGATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Acquire a basic knowledge on automation
- Familiarize in automation irrigation system
- Impart knowledge on IoT applications in irrigation systems
- Understand the role automation in surface and micro irrigation systems
- Illustrate the different kinds of parameters in irrigation automation

UNIT I INTRODUCTION TO AUTOMATION **9**

Automatic Irrigation – Traditional methods of Irrigation – Need for Automation – Comparison between Traditional and Automated Irrigation – Advantages – Disadvantages – Economic Impacts of Automation on Agricultural Firms – Future of Automation.

UNIT II SYSTEMS OF AUTOMATION **7**

Automated Irrigation – Pneumatic System – Portable timer system – Timer/Sensor Hybrid/SCADA – Methods of automating Irrigation layout – Machine Learning in Tank Monitoring System.

UNIT III IoT IN IRRIGATION **10**

IoT based Automated Irrigation System – IoT based Smart Irrigation – Sensor based Automation – types – operation – Solar based Automatic Irrigation System – components – operation – Automation by sensing soil moisture – Automation using ANN based controller – operation.

UNIT IV SURFACE AND MICRO-IRRIGATION AUTOMATION **11**

Automation and control in Surface Irrigation Systems – Equipments – benefits – barriers – Automation Design in Bay, Basin and Furrow Irrigation – Automation in Micro Irrigation – Systems of Automation and its components – Design – Cost – Operation and maintenance.

UNIT V ASSESSMENT OF PARAMETERS IN IRRIGATION **8**

Crop water estimate using Satellite data – Automation of Lysimeter for PET Measurements and Energy based Remote Sensing model – Remote Monitoring design of Automatic Irrigation system – Cost and Benefits of Automation.

TOTAL: 45 PERIODS

V. Gopalo

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Possess the knowledge on automation concepts
- Understand the automation systems in irrigation
- Identify suitable IoT technologies for irrigation management
- Apply automation concepts in surface and micro-irrigation concepts
- Assess the different parameters of irrigation automation systems

TEXTBOOK:

1. Dr. Garo A Pilawajian, Patrick T Balech and George E Saad. "Automated Irrigation System", Lambert Academic Publications, Maldova, 2018.
2. Haise H R and Kruse E G, "Automation of Surface Irrigation": 15 years of USDA Research and Development at Fort Collins, Colorado", 1981.

REFERENCES:

1. Brian Wahlin and Darell Zimbelman, "Canal Automation for Irrigation Systems", American Society of Civil Engineers, 2014.
2. Darell D Zimbelman, "Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system", American Society of Agricultural Engineers, 1987.

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BoS (AGE)

20AG404PE	MACHINE LEARNING FOR SOIL AND CROP MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Acquire knowledge about the fundamentals of machine learning and deep learning
- Understand the concepts of component analysis and regression
- Acquire deep knowledge on soil and crop characterization analysis sensors
- Impart applications of ML and DL for processing soil and crop images
- Understand the importance of digital image processing for soil in decision making

UNIT I MACHINE LEARNING AND DEEP LEARNING APPLICATIONS IN AGRICULTURE **9**

Dig data – machine learning, Artificial intelligence and deep learning – traditional uses of machine learning – supervised, unsupervised, semi supervised and reinforcement learning – applications of machine learning – precision agriculture – machine learning for crop management – machine learning for soil management – basics of multivariate data analysis.

UNIT II PRINCIPLE COMPONENT ANALYSIS AND REGRESSION **9**

Principle component analysis – dimensionality reduction – feature elimination – feature extraction – eigan value – screeplot – applications of Principal component analysis– principal component regression – partial least square regression.

UNIT III SOIL AND CROP SENSORS **9**

Historical and modern soil survey – proximal sensors – portable X-ray fluorescence spectrometry –PXRF applications for soil and crop – sensor fusion – nix sensor – nix for plant characterization.

UNIT IV ML AND DL FOR SOIL AND CROP IMAGE PROCESSING **9**

Machine learning for soil moisture prediction – ANN features and basic mathematical representation – convolutional neural network – digital image processing - color space models – soil image processing – crop image processing – image based soil property predictions

UNIT V DIGITAL SOIL MAPPING **9**

Digital soil mapping for decision making and policy management – covariates of digital soil mapping – digital elevation model – geographic information system – geographic coordinate system – universal transverse marketer – datum – geostatistics overview – kriging – inverse distance interpolation – variogram.

TOTAL: 45 PERIODS

V.Gopae

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know about the fundamentals of machine learning and deep learning
- Possess the knowledge on component analysis and regression
- Analyse the soil and crop sensors characterization
- Apply the techniques in ML and DL for processing soil and crop images
- Acquire the knowledge on digital image processing for soil in decision making

TEXTBOOKS:

1. Mohammed A K, Rijiwan K and Mohammed A A, "Application of Machine Learning in Agriculture", 1st Edition, Academic Press, 2022.
2. Jyotir Moy Chatterjee and Visal Jain, "Internet of Things and Machine Learning in Agriculture", Nova Science Publishers, 2021.

REFERENCES:

1. Latief Ahemed and Fisarath Nabi, "Agriculture 5.0: Artificial Intelligence, IoT and Machine Learning", 1st Edition, CRC Press, 2021.
2. Govind S P, Amrita R, Nripendra N D and Singh R P, "Smart Agriculture: Emerging Pedagogies of Deep Learning, Machine Learning and Internet of Things", 1st Edition, CRC Press, 2021.

V.G0220

CHAIRMAN
BoS (AGE)

20AG405PE	DRONE TECHNOLOGY FOR AGRICULTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the basics and business through drone concepts
- Learn and understand the fundaments of design, fabrication and programming of drone
- Impart the knowledge of an flying and operation of drone
- Know about the applications of drone in agriculture, picturing, power transmission and distribution
- Understand the safety risks and guidelines of fly safely

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept – Vocabulary Terminology– History of drone – Types of current generation of drones based on their method of propulsion– Drone technology impact on the businesses– Drone business through entrepreneurship– Opportunities/applications for entrepreneurship and employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV –Overview of the main drone parts– Technical characteristics of the parts –Function of the component parts –Assembling a drone– The energy sources– Level of autonomy– Drones configurations –The methods of programming drone– Download program –Install program on computer– Running Programs– Multi rotor stabilization– Flight modes –Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone –Flight modes– Operate a small drone in a controlled environment–Drone controls Flight operations –management tool –Sensors–On-board storage capacity –Removable storage devices– Linked mobile devices and applications.

UNIT IV APPLICATIONS OF DRONE IN AGRICULTURE 9

Choosing a drone based on the application –Drones in the insurance sector– Drones in delivering mail, parcels and other cargo– Drones in agriculture– Drones in inspection of transmission lines and power distribution –Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks– Guidelines to fly safely –Specific aviation regulation and standardization– Drone license– Miniaturization of drones– Increasing autonomy of drones – The use of drones in swarms.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Know about a various type of drone technology
- Execute the suitable operating procedures for functioning a drone
- Select appropriate sensors and actuators for Drones
- Develop a drone for agriculture uses
- Apply safety guidelines in drone technology

TEXTBOOKS:

1. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones", Maker Media, Inc, 2016.
2. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, Inc., 2021.

REFERENCES:

1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
2. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

V.GORE

CHAIRMAN
BoS (AGE)

20ME804PE

ROBOTICS
(COMMON TO MECH AND AGE)

L	T	P	C
3	0	0	3

OBJECTIVES:

The Students should be made to:

- Understand the components and functions of robots
- Study the various types of drive system and end effectors
- Know the concepts of machine vision system and robot kinematics
- Impart knowledge in robot programming and languages
- Learn safety issues and economic analysis of robots

UNIT I FUNDAMENTALS OF ROBOT 9

Robot – definition – robot anatomy – coordinate systems, work envelope types and classification – specifications – pitch, yaw, roll, joint notations, speed of motion, pay load – robot parts and their functions – need for robots – different applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic drives – hydraulic drives – mechanical drives – electrical drives – DC servo motors, stepper motors, AC servo motors – salient features, applications and comparison of all these drives. End effectors – grippers: mechanical grippers, pneumatic grippers, hydraulic grippers, magnetic grippers, vacuum grippers, two and three fingered grippers – internal and external grippers – selection and design considerations.

UNIT III MACHINE VISION SYSTEM AND ROBOT KINEMATICS 9

Introduction to machine vision – sensing and digitizing function in machine vision – image processing and analysis – robotic applications. Introduction to manipulator kinematics – homogeneous transformations and robot kinematics – manipulator path control – robot dynamics.

UNIT IV ROBOT PROGRAMMING AND LANGUAGES 9

Methods of robot programming – lead through programming, motion interpolation, robot programming languages – VAL programming – motion commands, sensor commands and end effector commands – Introduction of artificial intelligence – AI techniques – AI Vs Robotics – robotic paradigms

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

Rail Guided Vehicle (RGV) – Automated Guided Vehicle (AGV) – implementation of robots in industries - various steps – safety considerations for robot operations – economic analysis of robots.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the concepts of industrial robots and application of robots in different sectors
- Illustrate the different types of robot drive systems and end effectors
- Familiarize with image processing techniques and kinematic motions of robots
- Use the robot programming languages for different tasks
- Examine the implementation of robots and interpolate the economic analysis

CHAIRMAN
BoS (MECH)

TEXT BOOKS:

1. Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey and Ashish Dutta "Industrial Robotics - Technology, Programming and Applications", McGraw Hill Education (India) Private Limited, 2nd Edition, 2018.
2. Klafter R D, Chmielewski T A and Negin M, "Robotic Engineering – An Integrated Approach", Prentice Hall of India Private Limited, 2003.

REFERENCES:

1. Craig J J, "Introduction to Robotics Mechanics and Control", Pearson Education, 4th Edition, 2018.
2. Deb S R and Deb S "Robotics Technology and Flexible Automation", McGraw Hill Education, 2nd Edition, 2017.
3. Fu K S, Gonzalez R C and Lee C S G, "Robotics - Control, Sensing, Vision and Intelligence", McGraw Hill Education (India) Private Limited, 2019.

CHAIRMAN
BoS (MECH)

20AG406PE	OCCUPATIONAL SAFETY AND HEALTH IN AGRICULTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand about the policy for stake holders
- Study the provisions in safety equipment and its responsibilities
- Provide knowledge on different tools for agriculture activities and its safety
- Analyze the health problems of the workers
- Familiarize the material handling techniques

UNIT I INTRODUCTION AND MANAGEMENT SYSTEMS **9**

Introduction – National policy – Basic Safety Rules – Labour inspectorates – Hazard identification and risk assessment – Planning and implementation – Competence of managers, supervisors and workers.

UNIT II PERSONAL PROTECTIVE EQUIPMENT **9**

General provisions – Helmets and other head protection – Face and eye protection – Upper and lower limb protection – Respiratory protection – Hearing protection – Hygiene facilities and decontamination

UNIT III MACHINERY AND WORK EQUIPMENT SAFETY **9**

Introduction – Tractors and loughing vehicles – Machine Maintenance – Engineering controls in machinery – Safe working systems and procedures – Other agricultural machinery, equipment and tools harvesting vehicles and pesticides sprayers.

UNIT IV CHEMICAL AND BIOLOGICAL EXPOSURES **9**

Control strategies – Transport, storage and disposal of pesticides – pesticide handling – Medical and health surveillance of workers – Atmospheric and environmental control – Animal wastes – Injuries due to wild animals.

UNIT V ERGONOMICS AND HANDLING OF MATERIALS **9**

Introduction – Hazard – Elimination of ergonomic hazard through engineering controls, impact minimization, training workers and personal protective equipment – Material handling.

TOTAL: 45 PERIODS

CHAIRMAN
BoS (AGE)

OUTCOMES:

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

- Identify possible hazard and risk management
- Recognize the applications of different protection techniques for humans
- Choose the suitable maintenance for agriculture safety equipment
- Realize the special safety technique available for workers
- Adopt the best impact minimization through training the workers

TEXTBOOKS:

1. James A Dosman and Donald W Cockcroft, "Principles of Health and Safety in Agriculture", CRC Press, 1st Edition, 1989
2. Paul Gunderson, "Safety and health in agriculture", International Labour Office - Geneva: ILO, 2011.

REFERENCES:

1. Haldar S K, "Occupational Health and Hygiene in Industry", CBS Publishers And Distributors Pvt, Ltd, 2022.

V. GOPAL

CHAIRMAN
BoS (AGE)

20AG501PE	BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the concepts ofbiomass production
- Possess the knowledge on utilization of biogas from biochemical conversion methods
- Acquire deep knowledge on combustion process of thermochemical conversion
- Apply the concepts and utilization of thermochemical conversion by gasification and pyrolysis process
- Impart applications in the cogeneration and waste heat recovery

UNIT I BIOMASS CHARACTERIZATION **9**

Biomass – types – fuels from biomass. Terms and units used in biomass production. Biomass fuel characterization – physical, chemical and thermal – energy release. Supply chain – harvesting / collection – transportation and processing. Briquetting – types – pelletizing.

UNIT II BIOCHEMICAL CONVERSION **9**

Biochemical degradation – factors affecting biogas production – types of biogas plants – construction details – operation and maintenance – utilization of biogas – slurry handling, utilization and enrichment – high rate biomethanation process – landfills – bioethanol – feedstock – process – utilization - composting - methods – machinery.

UNIT III THERMO CHEMICAL CONVERSION BY COMBUSTION **9**

Thermochemical degradation. Stoichiometric air requirement – Combustion process – chemistry of combustion – combustion zones – emissions. Cofiring of biomass. Incinerators – layout. Combustion of wastes and MSW. Wood burning stoves – types – operation.

UNITIV THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS **9**

Biomass gasification – chemistry of gasification – types of gasifier – Gas cleaning & conditioning - utilization of producer gas - emissions – commercial gasifies plants. Pyrolysis – product recovery – types - biochar – bio oil – operation – recovery.

UNIT V COGENERATION AND WASTE HEAT RECOVERY **9**

Cogeneration technologies – cycles – topping – bottoming – problems – applications – selection. Waste heat recovery – plate heat exchangers – waste heat boilers – heat pumps – thermic fluid heaters – selection of waste heat recovery.

TOTAL: 45 PERIODS

V. GOPE

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Learn about the biomass fuel production from biomass
- Possess the knowledge on biogas production from biochemical conversion
- Acquire knowledge on thermochemical conversion techniques
- To know about the thermochemical of gasification and pyrolysis process
- Analyze the energy generated from waste

TEXTBOOKS:

1. Jhon Twidell, "Renewable Energy Resources", Taylor & Francis Ltd, 4th Edition, 2021.
2. Mathur, A N and Rathore N S, "Biogas production Management and Utilisation", Himanshu Publication, New Delhi, 1993.

REFERENCES:

1. Srivastava, P K, Shukla, B D and Ojha, T P, "Technology and application of biogas", Jain Brothers, New Delhi, 1993.
2. Rao S and B B Parulekar, "Energy Technology – Non conventional, Renewable and Conventional", Khanna Publishers, New Delhi, 1994.

V.GOPE

CHAIRMAN
BoS (AGE)

20EE604PE SOLAR ENERGY ENGINEERING AND TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the basics of solar energy
- Explain the operation of photovoltaic system
- Understand the concepts of flat plate collectors
- Analyze the performance of solar air heaters
- Compare the applications of various solar energy systems

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 – Solar radiation and sunshine measuring instruments – Geometry, angles and measurement – Estimation of radiation under different climatic conditions – Estimation of radiation in horizontal and inclined surface.

UNIT II PHOTOVOLTAIC SYSTEM **9**

Fundamentals of PV cells – Semiconductor physics – 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 FLAT PLATE COLLECTORS **9**

Basics of thermal collectors – Basics of heat transfer – Solar collector losses and loss estimation – Analysis of flat plate collector – Influence of various parameters on the performance of LFPC – Testing and application of LFPC.

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.

Chairman
BoS/EEE

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

OUTCOMES:

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

- Describe the concepts of solar measuring instruments
- Understand the basic components of solar PV system
- Analyze the performance of flat plate collectors
- Summarize the behavior of solar air heaters
- Examine the various applications of solar energy

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. Goswami D Y, Kreith F and Kreider J F, "Principles of Solar Engineering", Taylor and Francis, 1999.
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.

Chairman
BoS/EEE

20AG502PE	WIND ENERGY TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the fundamentals of wind energy and its conversion system
- Impart knowledge on airfoil design and braking system
- Learn gear coupled generator wind turbine components
- Brief on the working of different generators and power conditioning system used in grid tied wind systems
- Impart knowledge on modern wind turbine control and monitoring

UNIT I WIND ENERGY FUNDAMENTALS & WIND MEASUREMENTS 9

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, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis.

UNIT II AERODYNAMICS THEORY AND WIND TURBINE TYPES 9

Airfoil terminology, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads; Sources of loads Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall Control , Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync Generator.

UNIT III GEAR COUPLED GENERATOR WIND TURBINE COMPONENTS AND THEIR CONSTRUCTION 9

Electronics Sensors /Encoder /Resolvers, Wind Measurement : Anemometer & Wind Vane, Grid Synchronisation System, Soft Starter, Switchgear [ACB/VCB], Transformer, Cables and assembly, Compensation Panel, Programmable Logic Control, UPS, Yaw & Pitch System : ACDrives, Safety Chain Circuits, Generator Rotor Resistor controller (Flexi Slip), Differential Protection Relay for Generator, Battery/Super Capacitor Charger & Batteries/ Super Capacitor for Pitch System, Transient Suppressor / Lightning Arrestors, Oscillation & Vibration sensing.

UNITIV DIRECT ROTOR COUPLED GENERATOR (MULTIPOLE) [VARIABLE SPEED VARIABLE FREQ.] 9

Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up /Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits

V.GOPE

CHAIRMAN
BoS (AGE)

UNIT V MODERN WIND TURBINE CONTROL AND MONITORING SYSTEM **9**

Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA& Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, FACTS control &LVRT& New trends for new Grid Codes.

TOTAL: 45 PERIODS

OUTCOME:

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

- Analyze the energy in conversion techniques of wind energy
- Analyze the performance of wind turbine aerodynamics and breaking system
- Explain about various gear coupled generators with its construction
- Explain about different types of generators and power condition used in wind systems
- Analyze the concept of modern wind turbine control and monitoring

TEXTBOOKS:

1. C-WET: Wind Energy Resources Survey in India.
2. John D Sorensen and Jens N Sorensen, "Wind Energy Systems", Woodhead Publishing Ltd, 2011.

REFERENCES:

1. Kaldellis.J.K, "Stand – alone and Hybrid Wind Energy Systems", CRC Press, 2010.
2. Mario Garcia –Sanz, Constantine H. Houpis, "Wind Energy Systems", CRC Press 2012.
3. Spera, D.A., "Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering", ASME Press, 1994.

CHAIRMAN
BoS (AGE)

20AG503PE	ENERGY CONSERVATION AND WASTE HEAT RECOVERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Understand the basic thermodynamics concepts
- Possess the knowledge on power plant cycles
- Gain knowledge about the heat exchange network
- Acquire the concepts on thermal energy conversion
- Impart knowledge on energy storage concepts

UNIT I INTRODUCTION TO THERMODYNAMICS 9

Introduction to Waste Heat, Importance of Waste Heat Recovery, Introduction to First and Second Laws – Review of Thermodynamics – Entropy, Entropy Generation, First, and Second Law efficiency.

UNIT II HEAT RECOVERY GENERATIONS 9

Power Plant Cycles – Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples. Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine– Steam Turbine Power Plant, Heat Recovery Steam Generators.

UNIT III ENERGY AND COGENERATION 9

Thermodynamic cycles for low-temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and – NTU method – Analysis of Heat Exchanger – continued, Problem-solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger network.

UNIT IV THERMAL ENERGY TECHNOLOGIES 9

Heat pipes & Vapor Chambers, Direct conversion technologies – Thermoelectric Generators – Direct conversion technologies – Thermoelectric Generators (contd.), Thermoionic conversion, Thermo–PV, MHD.

UNIT V ENERGY STORAGE TECHNIQUES 9

Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction. Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage – Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells – Energy Economics.

TOTAL: 45 PERIODS

V. Gopi

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Apply thermodynamics concepts in waste heat recovery
- Select suitable power plant cycle
- Acquire knowledge on energy and cogeneration
- Enhancing knowledge about the applications of thermal energy
- Understand and Apply suitable energy storage system

TEXTBOOKS:

1. Taimoor Pervez, Sohaib Ejaz Randhawa, Nauman Sadiq, "Waste heat Recovery and Energy Conservation", Lambert Academic Publishing, 2011.
2. David Borge – Diez, Enrique Rosales – Asensio, "Heat Energy Recovery for Industrial Processes and wastes", Springer Publishing, 2023.

REFERENCES:

1. Tangellapalli Srinivas, "Thermal cycles of Heat Recovery Power Plants", Bentham Books Publishers, 2021.
2. Thipse, "Energy conservation and Management", Alpha Science Publishers, 2014.

V. Gopal

CHAIRMAN
BoS (AGE)

20EE503OE **ENERGY MANAGEMENT AND AUDITING** **L T P C**
3 0 0 3

OBJECTIVES:

The students should be made to:

- Understand the basics of energy management and audit process
- Analyze the economic value and energy management in lighting system
- Study the energy management involved in electrical equipments
- Perform the energy audit in HVAC system
- Give exposure on energy audit in industries

UNIT I INTRODUCTION **9**

Definition – Need for energy management – Energy basics – Designing and starting an energy management program – Energy auditing services – Energy audit process –Basic components of an energy audit.

UNIT II ENERGY MANAGEMENT IN LIGHTING SYSTEMS **9**

Introduction – Components of lighting systems – Lighting fundamentals – Lighting system components – Ballasts – Luminaries – Lighting controls – Process to improve lighting efficiency – New technology and approaches.

UNIT III ENERGY MANAGEMENT FOR MOTORS **9**

Effects of unbalanced voltages on the performance of motors – Power factor – Electric motor operating loads – Determining electric motor operating loads – Power meter – Slip measurement – Electric motor efficiency – Motor efficiency management – EMCS.

UNIT IV ENERGY AUDIT OF HVAC SYSTEMS **9**

Introduction to HVAC – Components of air conditioning system – Types of air conditioning system – Vapour compression refrigeration cycle – Energy use indices – Energy savings measures in HVAC – Star rating and labelling by BEE.

UNIT V ENERGY AUDIT **9**

Definition, Energy audit – Need, Energy scenario of India – Types of energy audit, methodology of energy audit – Energy savings measures in new buildings – Computer software and formats for energy audits.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the basic concept of energy management and auditing
- Demonstrate the effects of energy management in lighting
- Illustrate the energy efficient technologies in electrical systems
- Describe the concept of energy audit in HVAC system
- Emphasize the concepts of energy audit in industry

Chairman
BoS/EEE

TEXT BOOKS:

1. Wayne C Turner and Steve Doty, "Energy Management Handbook", The Fairmont Press, Inc, 6th Edition, 2007.
2. Sonal Desai, "Handbook of Energy Audit", McGraw–Hill Education, 2017.

REFERENCES:

1. Reay D A, "Industrial Energy Conservation", Pergamon Press, 2nd Edition. 1979.
2. Amit K Tyagi, "Handbook on Energy Audits and Management", TERI, 2003.
3. Eastop T D and Croft D R, "Energy Efficiency for Engineers and Technologists", Logman Scientific and Technical", ISBN–0–582–03184, 1990.
4. Barney L Capehart, Wayne C, Turner and William J.Kenned, "Guide to Energy Mangement", Fifth Edition, The Fairmont Press, Inc., 2006

Chairman
BoS/EEE

20AG504PE	WASTE AND BY-PRODUCT UTILIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Evaluate different by-products of the food industry and wastewater management
- Gain knowledge of various concepts of the chemical characteristics of solid waste
- Understand the process of waste-to-energy conversion
- Demonstrate different processing techniques
- Understand the process of disposal of solid waste

UNIT I INTRODUCTION TO WASTEWATER TREATMENT **9**

Types and formation of by-products and waste; the magnitude of Waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment.

UNIT II CHEMICAL PROPERTIES **9**

Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in wastewater, the microbiology of waste, and other ingredients like insecticide, pesticides, and fungicides residues.

UNIT III BY-PRODUCTS UTILIZATION **9**

Waste utilization in various industries, furnaces, and boilers run on agricultural wastes and by-products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, the concept of vermicomposting.

UNIT IV PROCESSING TECHNIQUES **9**

Pre-treatment of waste: sedimentation, coagulation, flocculation, and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.

UNIT V ADVANCED WASTEWATER TREATMENT PROCESSES **9**

Sand, coal, and activated carbon filters, phosphorous, sulphur, nitrogen, and heavy metals removal, Assessment, treatment, and disposal of solid waste; and biogas generation.

TOTAL: 45 PERIODS

V.Gopo

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Demonstrate various types of waste and influences
- Learn the concept of Wastewater management from any food industry
- Process the knowledge of By-product utilization from processing plants, cereals, and pulses
- Enhance knowledge about Hands-on training in the wastewater treatment process
- Understand the basic concept of Advance procession techniques for wastewater treatment

TEXTBOOKS:

1. Deepak Sharma, Neelam Rathore, and Kapil Kumar Samar, "Waste and By-product Utilization", Apex Publishers, Udaipur, 2020.
2. Sanju Bala Dhull, Ajay Singh and Pradynman Kumar, "Food Processing Waste and Utilization", CRC press Publishers, Boca Raton, 1st edition, 2022.

REFERENCES:

1. Vasso Oreapoulou and Winfried Russ, "Utilization of By-Products and Treatment of Waste in the Food Industry", Springer Publishers, India, 2nd edition, 2007.
2. Joshi Viral, "Agricultural Waste and By-Product Utilization", LAP Lambert Academic Publishers, USA, 2019.

V.Gopo

CHAIRMAN
BoS (AGE)

20AG505PE	ENERGY ECONOMICS AND POLICIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to,

- Evaluate different classifications of natural resources and economic development
- Understand the concept of the role of energy in economic development and various international institutions
- Gain knowledge about energy and the environmental problems directly related to energy production and consumption
- Demonstrate the basic concept of energy planning and conservation
- Develop skills in various Indian energy sectors and policies

UNIT I INTRODUCTION TO ENERGY ECONOMICS **9**

Natural Resources – Classification – Importance – Role of Natural Resources in Economic Development – Energy Resources – Classification – Properties and Forms of Energy –Energy Economics – origin, Scope, and Nature.

UNIT II ENERGY AND DEVELOPMENT **9**

Role of Energy in Economic Development – Energy Indicators – Energy Intensity and Energy Elasticity – National and International Comparison – Role of International Institutions – OPEC, OAPEC, IEA, and World Bank.

UNIT III ENERGY AND ENVIRONMENT NEXUS **9**

Energy Environment Nexus Crisis – Causes and Consequences – Remedial Measures – Impact of Energy Consumption and Production on Environment with illustrations – Role of Energy Economists in solving Energy Crises.

UNIT IV ENERGY PLANNING AND MANAGEMENT **9**

Energy Planning and Energy Conservation – Meaning, Objectives, and Importance – Energy Management – Meaning, Objectives, and Importance – Recent Developments: Energy Auditing – Energy Accounting – Energy conservation - Energy Pricing and Taxes – Role of Economists in Sustainable Energy Management.

UNIT V INDIA'S ENERGY PROFILE **9**

Indian Energy Sector – Organizational Structure – Energy Supply sources and trends in production – Energy Demand on sectoral consumption trend – Renewable Energy Sources and Technologies – Renewable Energy Programmes in India - Carbon Trading, Energy Policies and Legislations.

TOTAL: 45 PERIODS

V.Gopi

CHAIRMAN
BoS (AGE)

OUTCOME:

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

- Demonstrate various types of alternative clean energy sources
- Learn the concept of key sources of economic growth and consumption activities involving energy as a basic input
- Process the knowledge of consumption of products and services impacts the environment in many different ways
- Enhance knowledge about planning and conservation of energy
- Understand the basic concept of renewable energy technologies and programs in India

TEXTBOOKS:

1. James M G, and Henry B S, "Energy Economics and Policy", Academic Press Publishers, Second edition, 1986.
2. Subhes C. Bhattacharyya, "Energy Economics", Springer Publishers, 2012.

REFERENCES:

1. Dr.C.Vinodan, "Energy Security choices for India", New Century Publishers, 1st edition, 2022.
2. Usha Tandon, "Energy Law and Policy," Oxford University Press Publishers, 2018.

V.Gopi

CHAIRMAN
BoS (AGE)

20MG701	TOTAL QUALITY MANAGEMENT	L	T	P	C
	(COMMON TO AGE, CIVIL, CSE, ECE, EEE, IT AND MECH)	3	0	0	3

OBJECTIVES:

The Students should be made to:

- Provide an overview of basic approaches of TQM
- Familiarize with the concepts and principles of TQM
- Impart knowledge on basic and new quality tools
- Learn the applications of TQM techniques in various industries
- Understand the various quality systems, standards and procedures

UNIT I INTRODUCTION **9**

Definition of quality and TQM – basic needs of quality – contributions of Deming, Juran and Crosby – TQM framework – historical 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 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.

UNIT III TQM TOOLS **9**

Basic seven tools of quality – new seven management tools – six sigma – concepts and process – quality costs – 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

OUTCOMES:

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

- Implement the concept of quality, TQM to bring quality management
- Improve the customer supplier relationship management and enrich the employee involvement
- Apply the basic and new quality tools for enhancing quality
- Explore the usage of TQM techniques for measuring, controlling and improving the quality
- Execute the various quality systems, its standards and procedures to increase the quality assurance

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TEXT BOOKS:

1. Dale H Besterfiled, "Total Quality Management", Pearson Education Asia, 3rd Edition, 2013.
2. Poonia M P and Sharma S C, "Total Quality Management", Khanna Publication, 1st Edition, 2018.

REFERENCES:

1. James R Evans and William M Lindsay, "The Management and Control of Quality", South-Western Cengage Learning, 6th Edition, 2010.
2. Vijayan V and Ramakrishnan H "Total Quality Management", S Chand Publication, Pune, 1st Edition, 2014.
3. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd, 7th Edition, 2011.
4. Poornima M Charantimath, "Total Quality Management", Pearson Education, 3rd Edition, 2017.

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20AG603PE	AGRICULTURAL BUSINESS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Expose the importance of Agri-business management and its characteristics
- Understand the principles and management approaches of agri-business organizations
- Impart knowledge on the functions and planning of agricultural marketing
- Introduce basic knowledge on agricultural business finance activities
- Get familiarize on market promotions and human resource management

UNIT I CONCEPTS OF AGRICULTURAL BUSINESS **9**

Agri-business – scope, characteristics, types. Management – importance, definition, management and administration, management thoughts, Small business – characteristics and stages of growth – Management functions – planning, organizing, leading.

UNIT II AGRI – BUSINESS ORGANIZATION **9**

Principles, forms of agri-business organizations, staffing, directing, supervision and motivation. Controlling – types, performance evaluation and control techniques. Management approaches – Profit Centered Approach, Management by objectives and Quality Circles. Strength, Weakness, Opportunities and Threat (SWOT) Analysis.

UNIT III AGRICULTURAL MARKETING **9**

Functional areas of Agri-business – Production and Operations management – functions, planning physical facilities and managing quality. Agro-inputs and products inventory management – raw material procurement, inventory types and costs. Marketing management – Marketing environment, marketing mix – Agricultural input marketing firms.

UNIT IV AGRICULTURAL BUSINESS FINANCE **9**

Forms of agri-business organizations – Role of lead bank in agribusiness finance – Financial management. Acquiring capital – Budget analysis. Concepts and determinants – Business project scheduling of raw material procurement – production management – launching products (branding and placement) – Input marketing promotion activities.

UNIT V MARKET PROMOTION AND HUMAN RESOURCES **9**

Agricultural products – marketing promotion activities – product pricing methods. District Industries Centre – Consumer survey – Agricultural inputs retailing – Market potential assessment – types of distribution channels – Return on Investment – Personnel management. Recruitment, selection and training – Technology in Agri Business.

TOTAL: 45 PERIODS

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OUTCOME:

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

- Analyze agri-business management, functions and organization
- Start and lead the agri-business organization
- Get familiarize with agriculture marketing concepts and skills
- Analyze Agricultural Business Finance activities and able to start agri-business
- Apply the skills for effective agriculture marketing by utilization of human resources

TEXTBOOKS:

1. Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2008.
2. Smita Diwase, "Indian Agriculture and Agribusiness Management", 3rd Edition, Krishi resource Management Network, Pune, 3rd Edition, 2017.

REFERENCES:

1. Chandra Prasanna, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Publications, New Delhi, 2019.
2. Meena G L , "Fundamentals of Agribusiness Management", ATPA Publication, 2017.
3. Kotler P, "Marketing Management. Analysis, Planning and Control", Prentice Hall Inc., New York, 10th Edition, 2000.

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20AG602PE SUSTAINABLE AGRICULTURE AND FOOD SECURITY

L	T	P	C
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OBJECTIVES:

The student should be made to:

- Understand about the importance of the land and water resources in India
- Study the importance of Rainfall, surface water and ground water
- Impact of climate change on sustainable natural agriculture
- Illustrate the importance of science in food production and security.
- Apply various policies and programmes for sustainable agriculture management

UNIT I LAND RESOURCE AND ITS SUSTAINABILITY **9**

Land Resources of India – population and land. Land utilization – net area sown, changes in cropping pattern, land degradation.

UNIT II WATER RESOURCE AND ITS SUSTAINABILITY **9**

Rainfall forecasting – adequacy of rainfall for crop growth – rainfall, drought and production instability – irrigation potential – available, created and utilized – river basins; watersheds and utilizable surface water – utilizable water in future (ground water & surface water).

UNIT III SUSTAINABLE AGRICULTURE & ORGANIC FARMING **9**

Agro-ecosystems – Impact of climate change on Agriculture, Effect on crop yield, and effect on Soil fertility – Food grain production at State Level – Indicators of Sustainable food availability – Indicators of food production sustenance – Natural farming principles – Sustainability in rain fed farming – organic farming – principles and practices.

UNIT IV FOOD PRODUCTION AND FOOD SECURITY **9**

Performance of Major Food Crops over the past decades – trends in food production – Decline in total factor productivity growth – Demand and supply projections – Impact of market force – Rural Land Market – Emerging Water market – Vertical farming – Sustainable food security indicators and index – Indicator of sustainability of food Security – Path to sustainable development.

UNIT V POLICES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY **9**

Food and Crop Production polices – Agricultural credit Policy – Crop insurance –Policies of Natural Resources Use – Policies for sustainable Livelihoods – Virtual water and trade – Sustainable food Security Action Plan.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Gain knowledge on the land utilization and changes in cropping pattern for sustainable agriculture
- Demonstrate how water is important for sustainable agriculture
- Comprehend the need for food security on global level and the nutritional security
- Know about indicators of natural food production and organic farming
- Idea about food and crop production policies for sustainable growth

TEXTBOOKS:

1. Desai B K and Pujari B T, "Sustainable Agriculture: A vision for future", New India Publishing Agency, New Delhi, 2007.
2. Saroja Raman, "Agricultural Sustainability: Principles, Processes and Prospects", CRC Press, 1st Edition 2006.

REFERENCES:

1. Banerjee and Gangadhar, "Economics of sustainable agriculture and alternate production systems", Ane Books Pvt Ltd, New Delhi, 2017.
2. Swaminathan M S, "Science and sustainable food security", World Scientific Publishing Company, 2010.
3. Sitambaranadhan J, "Ecosystem Principles and Sustainable Agriculture", Scitech Publications (India) Pvt Ltd, 1999.

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20AG601PE	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the global trends and development methodologies of various types of products and services
- Impart knowledge on requirement engineering and system modelling
- Develop conceptualize design with hardware testing
- Explore documentation, test specifications and validate support activities for customer
- Get familiarize with manufacturing, purchase and assembly of systems

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT **9**

Global trends analysis and product decision –Social trends – Technical trends– Economical Trends – Environmental trends – Political/Policy trends – Introduction to product Development methodologies and management –Overview of products and services –Types of product Development – Overview of product development methodologies –Product life cycle – Product development planning and management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN **9**

Requirement engineering –Types of requirements – Requirement engineering –traceability Matrix and analysis – Requirement management –System design & modeling–Introduction to system modeling– System optimization – System specification –Sub-system design – Interface design.

UNIT III DESIGN AND TESTING **9**

Conceptualization –Industrial design and user interface design – Introduction to concept generation Techniques – Challenges in integration of engineering disciplines – Concept screening &evaluation –Detailed design –Component design and verification – Mechanical, electronics and software subsystems – High level design/low level design of S/W Program – Types of prototypes, S/W testing– Hardware schematic, Component design, Layout and hardware testing – Prototyping –Introduction to rapid prototyping and rapid manufacturing – System integration, testing, certification and documentation.

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFESUPPORT **9**

Introduction to product verification processes and stages – Introduction to product validation processes and stages – Product testing standards and certification – Product documentation – Sustenance –Maintenance and repair – Enhancements –Product EoL–Obsolescence management – Configuration management –EoL disposal.

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UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry –Engineering services industry – Product Development in industry versus academia –The IPD essentials –Introduction to vertical specific product development processes –Manufacturing/Purchase and assembly of systems – Integration of mechanical, embedded and software systems – Product development trade-offs – Intellectual property rights and confidentiality – Security and configuration management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Define, formulate and analyze a global level problem
- Understand specific problems with System design and modeling
- Develop detailed design and proper documentation
- Apply work independently as well as in teams for solving end-of-life problems
- Gain knowledge on Intellectual property rights and confidentiality in the business context

TEXTBOOKS:

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGrawHill, 6th Edition, 2016.
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, 12th Edition, 2001.

REFERENCES:

1. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, 7th Edition, 1992.
2. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts and Practice", Second Edition, PHI learning private limited, 2011.
3. Hiriyappa B, "Corporate Strategy – Managing the Business", Author House, 2013.

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20MG801PE	ENTREPRENEURSHIP ESSENTIALS	L	T	P	C
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OBJECTIVES:

The Students should be made to:

- Acquire knowledge on competencies of an entrepreneur
- Know about the opportunities and startup strategies
- Discuss the various models of business plan
- Describe development of market strategies and financial analysis.
- Know the role of government and other agencies in promoting entrepreneurship

UNIT I INTRODUCTION TO ENTREPRENEURSHIP **9**

Introduction – vision, mission and values of entrepreneurship – entrepreneurial qualities – economic contributions of entrepreneurs – types of entrepreneurship – myths and realities around entrepreneurship – inspiring stories of entrepreneurship.

UNIT II THE ENTREPRENEUR **9**

Motivation – identifying opportunities based on trend – circle of competence and effectuation – lean startup – marketing for startups – marketing research – forms of legal entities – causes of failure of startups – factors driving competitive advantages.

UNIT III BUSINESS PLAN **9**

Introduction – design and innovation – business model canvas – value proposition canvas – features of winning business models – business model innovation – production plan – operations plan – marketing plan – organizational plan – financial plan – pitching the business plan.

UNIT IV INTRODUCTION TO FINANCIAL STATEMENTS **9**

Depreciation and amortization – treatment of capital gain – loss from sale of fixed asset – cost, volume, profit and break-even point analysis – market strategies – capital budgeting decisions – start up valuation – founding team and early recruits.

UNIT V FUNDING THE NEW VENTURE **9**

Source of capital – debt or equity financing – types of ownership securities – internal and external funds – commercial banks – role of Small Business Administration (SBA) in small business financing – Some dos and don'ts of financing – government grants – growth strategies – human resource management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Know the concepts and values of entrepreneurship
- Illustrate the different traits of an entrepreneur
- Develop the innovation and pitching of a business plan
- Understand the role of financing and market strategies
- Identify various sources of finance and institutions supporting entrepreneurship

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TEXT BOOKS:

1. Khanka S S, "Entrepreneurial Development", Chand & Company Ltd., 5th Edition, 2013.
2. Robert D Hisrich, Veland Ramadani, "Effective Entrepreneurial Management", Springer, 1st edition, 2017.

REFERENCES:

1. Robert D Hisrich, Michael P Peters, Dean A shepherd, "Entrepreneurship", Tata McGraw Hill Education, 10th Edition, 2019.
2. Barringer and Ireland, "Entrepreneurship", Pearson Education, 6th Edition, 2018.
3. Raj Shankar, "Entrepreneurship, Theory and Practice", Vijay Nicole Imprints Pvt. Ltd., 2012.
4. Zimmer and Scarborough, "Essentials of Entrepreneurship and Small Business Management", PHI Learning Pvt. Ltd., 5th Edition, 2009.

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BoS (MECH)

20GE501PE	INTELLECTUAL PROPERTY RIGHTS (COMMON TO AGE, CSE, EEE, IT AND MECH)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study the basics of Intellectual property
- Impart knowledge on trademarks
- Learn about the importance of copyrights
- Acquire knowledge on patent laws
- Know about trade secrets and industrial designs

UNIT I INTRODUCTION TO INTELLECTUAL PROPERTY 9

Intellectual property law basics – Types of Intellectual property – Patents – Copyrights – Geographical indications – Nature of Intellectual property – Industrial property – Technological research – Inventions and Innovations.

UNIT II THE LAW OF TRADEMARKS 9

Purpose and functions of trademarks – Types of trademarks – Trade names and Business names – Trademark selections and searching – Trademark registration process – Trademark maintenance and transfer of rights to marks – New developments in trademark law – International trademark law.

UNIT III THE LAW OF COPYRIGHTS 9

Foundation of copyright law – Subject matter of copyright – Copyright ownership, transfer and duration – Copyright infringement – International copyright law.

UNIT IV LAW OF PATENTS 9

Foundation of patent law – Patent searches, applications & Post Issuance proceedings – Patent ownership and transfer – Patent Infringement – New development and International patent law.

UNIT V THE LAW OF TRADE SECRETS AND UNFAIR COMPETITIONS 9

Trade secret laws – Importance of trade secret - Unfair competitions – Intellectual property audits and due diligence reviews – Industrial designs – Difference between patents, copyright, trademark - Application of different forms of IPR.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply the concepts of Intellectual property
- Create their own trademarks for the business
- Understand the registration process of copyrights
- Gain knowledge on filing procedure patents
- Maintain the trade secrets and create industrial designs

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TEXT BOOKS:

1. Deborah E Bouchoux, "Intellectual property, The laws of Trademarks, Copyrights, Patents & Trade secrets", Delmar Cengage learning, 4th Edition, 2012.
2. Neeraj Pandey, Khushdeep Dharni, "Intellectual Property Rights", Eastern Economy Edition, PHI Learning Pvt Ltd., 2014.

REFERENCES:

1. Satakar S P, "Intellectual Property Rights and Copy Rights", ESS Publications, New Delhi, 2003.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata McGraw Hill Publishing Company, 2011.
3. Louis TC Harms, "Enforcement of Intellectual Property Rights" , World Intellectual Property Organization", 3rd Edition, 2012.
4. Ramakrishna B, Anil Kumar H S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent layers", Nation press, 2017.

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BoS (MECH)

20AG604PE	ORGANIC FARMING FOR SUSTAINABLE AGRICULTURAL PRODUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Impart knowledge on organic farming and its key indicators
- Understand the different management practices under organic cultivation of crops
- Learn the organic crop management concepts in vegetable, field and plantation crops
- Gain knowledge about importance of modern transition towards organic farming
- Acquire a basic knowledge on health nutrition and quality of organic farming products

UNIT I INTRODUCTION TO ORGANIC FARMING 9

Organic farming: Introduction – Concepts and principles of organic farming –Components of organic farming –SWOT analysis of organic farming –Sustainable agriculture: Key indicators of sustainable agriculture, organic farming and climate change.

UNIT II INPUT MANAGEMENT AND PLANT PROTECTION MEASURES 9

Input management; Principles of compost production, vermin composting, compost quality, compost utilization and marketing – Introduction to pest and disease management in organic farming.

UNIT III 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 IV MODERN TRANSITION TO ORGANIC CROP PRODUCTION 9

Introduction on transition to organic crop production – Crop planning and rotation design in organic system – Integrated farming system and urban agriculture.

UNIT V QUALITY AND MARKETING 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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OUTCOMES:

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

- Gain fundamental knowledge on organic farming concepts
- Identify suitable crop input and plant protection measures for organic farming
- Explore the different organic crop management systems
- Understand implications of modern transition towards organic farming
- Illustrate quality and proper marketing channel for marketing of organic products

TEXTBOOKS:

1. Sharma A, "Hand book of Organic Farming", Agrobios, 2011.
2. Somasundram E D, Udhaya Nandhini and Meyappan M, "Principles of Organic Farming", CRC Press, New Delhi, 2021.

REFERENCES:

1. Gupta S K, "Organic vegetable production", Rajat Publications, New Delhi, 2020.
2. Singh S K, R B Yadav, Jagdish singh and Bijendra singh, "Organic Farming in Vegetables", ICAR Technical Publication, New Delhi, 2017.

V.GORE

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BoS (AGE)

20BM501OE BASICS OF BIOMEDICAL INSTRUMENTATION **L T P C**
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OBJECTIVES:
The student should be able to:

- Gain knowledge about various physiological parameters of both electrical and non-electrical.
- Add insights on the various methods of recording and also the methods for transmitting these parameters.
- Study about the various assist devices used in hospitals.
- Gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT 1 ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of biomedical signals, Bio-potentials, Bio-potential electrodes, Biological amplifiers, ECG, EEG, EMG, PCG, Typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMENTER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, Respiratory, Blood pressure, Temperature and Pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES AND IMAGING SYSTEMS 9

Cardiac Pacemakers, DC Defibrillator, Dialyzer, Ventilators, Computed Tomography, Magnetic Resonance Imaging systems, Ultrasonic Imaging systems (Block diagram approach will be enough)

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies – Shortwave, Ultrasonic and Microwave type and their applications, Surgical diathermy, Biotelemetry

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio Pill, Endoscopy, Brain Machine Interface, Lab on a Chip

TOTAL : 45 PERIODS

OUTCOME:

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

- Know the human body electro-physiological parameters and recording of bio-potentials
- Comprehend the non-electrical physiological parameters and their measurement-body temperature, blood pressure, pulse, blood cell count, blood flow meter…
- Interpret the various assist devices used in the hospitals viz pacemakers, defibrillators, dialyzers and ventilators
- Comprehend physical medicine methods. e.g) Ultrasonic, Shortwave, Microwave surgical diathermies and bio-telemetry principles and methods.
- Know about recent trends in medical instrumentation.

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TEXT BOOK:

1. Leslie Cromwell, - Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007.

REFERENCES:

1. Khandpur R S., Handbook of Biomedical Instrumentation, Tata McGraw Hill New Delhi, 2003.
2. John G Webster., Medical Instrumentation Application and Design, 3rd Edition, Wiley India, 2007.
3. Joseph J Carr and John M Brown., Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 2004.

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BoS/BME

20BM502OE **INTRODUCTION TO CELL BIOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:
The student should be able to:

- Provide knowledge on cell structure and junctions
- Know the membranes and cell wall
- Be acquainted with cell division and its cycles
- Become aware of the significance of DNA and RNA, Proteins.
- Identify various enzymes and its use in industries

UNIT I CELL STRUCTURE **9**
Cell organization, structure of organelles, extra cellular matrix and cell junctions

UNIT II CELL ORGANELLE AND FUNCTION **9**
Nucleus, Mitochondria, Lysosomes, Endoplasmic reticulum, Golgi apparatus, vesicles, centrosomes, cell membranes, ribosomes, cytosol, chloroplasts, flagella, cell wall.

UNIT III DIVISION **9**
Cell cycle – mitosis, meiosis, cell cycle regulation and apoptosis.

UNIT IV MACROMOLECULES **9**
DNA, RNA and Proteins – basic units, architectural hierarchy and organization, functions.

UNIT V ENZYMES **9**
Enzymes – Structure, Mechanism of action, Factors that affect enzyme activity, Common enzymes used in industrial setup of plant and animal origin

TOTAL: 45 PERIODS

OUTCOME:
On successful completion of this course, the student should be able to:

- Identify the structure of the cell and its functions
- Recognize the functions of cell wall and membrane
- Familiar with the cell cycle and its characteristics
- Apply the knowledge of DNA and RNA to study different characteristics
- Comment of various enzymes and its role by doing thorough analysis

TEXT BOOKS:

1. Lodish, Harvey etal., " Molecular Cell Biology", 5th Edition, W. H. Freeman, 2005.
2. Cooper, G.M. and R.E. Hansman "The Cell: A Molecular Approach", 4th Edition, ASM Press, 2007.
3. Alberts, Bruce etal., "Molecular Biology of the Cell", 4th Edition, Garland Science (Taylors Francis), 2002.

REFERENCES:

1. McDonald, F etal., "Molecular Biology of Cancer" 2nd Edition, Taylor & Francis, 2004.
2. King, Roger J.B. "Cancer Biology" Addison Wesley Longman, 1996.

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20CE501PE INDUSTRIAL WASTE MANAGEMENT

L	T	P	C
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OBJECTIVES:

The student should be made to:

- Understand the various characteristics of industrial waste water.
- Learn the process and mechanism of different waste water treatment process.
- Impart awareness on waste that emits from industries.
- Gain knowledge on biological waste water treatment process.
- Familiarize with 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.

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UNIT IV BIOLOGICAL WASTE WATER TREATMENT PROCESS 9

Lagoons and stabilization basins – Aerated lagoons-activated sludge processes – Trickling filtration – Rotating biological contactors – Anaerobic decomposition-laboratory evaluation of anaerobic treatment – Adsorption – Theory of activated carbon – Sludge quality considerations – Stripping of volatile organics – Nitrification and denitrification.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

Characteristics of sludge for disposal – Aerobic digestion – Gravity thickening – Flotation thickening – Rotatary drum screen – Gravity belt thickener – Centrifugation – Vacuum filtration – Pressure filtration – Belt filter press – Sand bed drying-factors affecting dewatering performance – Land disposal of sludges – Incineration.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, learners will be able to:

- Gain knowledge on undesirable waste water characteristics.
- Understand various methods dealt with treatment of waste water.
- Learn various sources, types, characteristics and disposal methods of industrial waste water.
- Acquire knowledge on different types of aerobic and anaerobic waste water treatment process.
- Aware with various sludge treatment methods and its disposal.

TEXT BOOKS:

1. Wesley Eckenfelder W, Jr Industrial Water Pollution Control 3rd Edition, Mc–GrawHill Book Company, New Delhi, 2000.
2. Stephenson R L and Blackburn J B, Industrial Wastewater Systems Hand book, Lewis Publisher, New York, 1998.

REFERENCE BOOKS:

1. M.N.Rao & A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication, 1995.
2. H.M. Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995.

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20CE502PE AIR POLLUTION AND CONTROL ENGINEERING

L	T	P	C
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OBJECTIVES:

The student should be made to:

- Impart knowledge on ambient air quality and emission standards.
- Learn effects of meteorology on air pollution.
- Understand various types of particulate contaminants with its sources and control measures.
- Gain awareness on different types of gaseous contaminants and its preventive measures.
- Study various sources, types and control of indoor air pollutants.

UNIT I INTRODUCTION 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT II METEOROLOGY 9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

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UNIT V INDOOR AIR QUALITY MANAGEMENT **9**

Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control- Sources and Effects of Noise Pollution – Measurement – Standards – Control and Preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the nature and characteristics of air pollutants.
- Analyze the fundamentals on effects of meteorology in air pollution.
- Design stacks and particulate air pollution control devices to meet applicable standards.
- Learn control devices of gaseous contaminants with design standards.
- Maintain indoor quality management.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd.,India 2002.

REFERENCE BOOKS:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C Stern, "Air Pollution (Vol. I – Vol. VIII)", Academic Press, 2006.
3. Wayne T Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc., 2000.

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20CE602OE SMARTMATERIALS AND SMART STRUCTURES L T P C

3 0 0 3

OBJECTIVES:

The student should be made to:

- Able to understand the concepts of various smart structures.
- Gain knowledge on various sensing technologies.
- Learn the working principles of various actuators.
- Impart knowledge on various signal processing and control systems.
- Acquire knowledge on applications of smart structures.

UNIT I INTRODUCTION **9**

Structures – Materials – Hybrid structures – Smart structures – Instrumented structures – Function and responses in instrumented structures – Structural responses – Sensing systems – Signal processing consideration – Actuation systems and effectors – Application sectors.

UNIT II SENSORS **9**

Sensing technologies – Specification and terminology for sensors in smart structures – Sensor options – Piezoelectric strain measurement – Inductively read transducers – Fibre optic sensing techniques – Other techniques – Chemical and bio chemical sensing in structural assessment – Absorptive chemical sensors – Sensor systems.

UNIT III ACTUATORS **9**

Actuator techniques – Mechanical impedaries, Conversion efficiencies and matching – Actuators and actuators materials – Piezo electric and electro astrictive materials – Magnetostrictive materials – Shape memory alloys – Electromagnetic actuation – Hydraulics.

UNIT IV SIGNAL PROCESSING AND CONTROL SYSTEMS **9**

Introduction – Sensors as geometrical processors – Signal processing – Control systems – The linear and nonlinear – Smart structures applications.

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UNIT V SMART STRUCTURES APPLICATIONS 9

Introduction – Civil structural monitoring – An active building – Adaptive truss structures – Smart composites and self testing structures – Biological aspiration – Designer engineering for future structures – Material synthesis.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Aware various principles of smart and hybrid structures.
- Be familiar with specification and terminologies for sensors used in smart structures.
- Apply actuator techniques in smart structures.
- Develop sensors as geometrical processors.
- Equip with applications of smart structures.

TEXT BOOKS:

1. Brain Culshaw,"Smart Structure and Materials", Boston: Artech (House) Publishers, London, 1st Edition1996.

REFERENCE BOOKS:

1. Srinath L S, "Experimental Stress Analysis", Tata McGraw Hill, 1998.
2. DallyJ W and Riley W F, "Experimental Stress Analysis", Tata McGraw Hill, 1998.

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20CS501OE FUNDAMENTALS OF SOFTWARE ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Explore the fundamental concepts of software engineering
- Learn the requirements engineering process and planning for software development
- Understand the software design principles
- Know coding standards and different testing strategies
- Learn the project management principles and quality assurance standards

UNIT I SOFTWARE AND SOFTWARE ENGINEERING **8**

The Nature of Software - Software Engineering - Software Myths – Process Models: Prescriptive Process Models, Specialized Process Models, Personal and Team Process Models – Overview of Agile Process -Overview of CMMi

UNIT II REQUIREMENTS ENGINEERING AND PLANNING **10**

Requirements Engineering: Establishing the Groundwork - Eliciting Requirements - Negotiating Requirements - Validating Requirements - Requirements Analysis using scenario based modeling. Process and Project Metrics: Software Measurement - Metrics for Software Quality. Estimation: The Project Planning Process – Resources - Software Project Estimation - Decomposition Techniques - Empirical Estimation Models - Project Scheduling

UNIT III MODELLING AND DESIGN **9**

Modelling: Data Modeling Concepts - Class-Based Modeling - Flow-Oriented Modeling - Creating a Behavioral Model Design Concepts - Architectural Design: Software Architecture, Architectural Styles, Architectural Design, Architectural Mapping Using Data Flow - User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis

UNIT IV CODING AND SOFTWARE TESTING **9**

Coding standards and guidelines - Testing: Strategic approach to Software Testing - Test Strategies for Conventional Software - Validation Testing - System Testing – Debugging – White-box Testing - Basis Path Testing - Control Structure Testing - Black-box Testing

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UNIT V PROJECT MANAGEMENT AND SOFTWARE QUALITY 9

Project Management Concepts: The Management Spectrum, People, Product and Process – Software Configuration Management – Risk Management - Quality Management: Software Quality, Achieving Software Quality - Elements of Software Quality Assurance - The ISO 9000 Quality Standard

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply software engineering principles for software development.
- Formulate software requirement specification and plan for software development
- Design software according to the specification
- Code the software using guidelines / standards and conduct testing
- Manage and maintain the software process by assuring the quality

TEXT BOOKS:

1. Roger S. Pressman and Bruce R. Maxim, "Software Engineering – A practitioner's approach", McGraw Hill Publications, Eighth Edition, 2014

REFERENCES:

1. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, Third Edition, 2005
2. Ian Sommerville, "Software engineering", Pearson Education Asia, Seventh Edition, 2007.
3. Watts S.Humphrey, "A Discipline for Software Engineering", Pearson Education, 2007.
4. James F.Peters and WitoldPedrycz, "Software Engineering, Engineering Approach", Wiley-India, 2007.
5. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill, 2007.
6. S.A.Kelkar, "Software Engineering", Prentice Hall of India Pvt, 2007

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20CS507OE INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS **L T P C**

(Common to AGE, BME, CIVIL, EEE and MECH) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Introduce the basics of problem solving techniques and analysis of algorithms
- Learn the various searching and sorting techniques
- Impart knowledge on ADTs such as List, Stack, Queue
- Explore the binary trees and priority queues
- Get exposure on hashing techniques and graphs

UNIT I ANALYSIS OF ALGORITHMS **9**

Introduction to Algorithms and algorithmic problem solving – Problem types. Analysis of Algorithms: Analysis Framework - Asymptotic Notations – Best case, worst case and average cases - Mathematical analysis of non-recursive algorithms - Recurrence equations – Solving recurrence equations - Mathematical analysis of recursive algorithms.

UNIT II SEARCHING AND SORTING ALGORITHMS **9**

Search Algorithms: Linear search - binary search - Analysis of Search algorithms. Sorting Algorithms: Bubble sort - Exchange sort - Insertion sort – Merge sort – Quick sort – Heap sort - Analysis of Sorting Algorithms.

UNIT III LISTS, STACKS AND QUEUES **9**

Abstract Data Types – The List ADT – Singly Linked List – Doubly Linked List – Circular Linked List – Applications and analysis of List. The Stack ADT – Applications and Analysis of Stack. The Queue ADT – Applications and Analysis of Queues.

UNIT IV TREES AND HEAPS **9**

Preliminaries – Binary Trees – Expression Trees- Traversals. The Search Tree ADT – Binary Search Trees – Applications of BST. Priority Queues – Binary heap – Heap operations - Applications of heaps.

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UNIT V HASHING AND GRAPHS 9

Hashing – Closed hashing: Separate Chaining – Open Addressing - Linear probing. Graph ADT – Representation of graph – Graph Traversals: DFS and BFS. Applications of Graph - Finding Shortest Path - Connected components.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze recursive and non recursive algorithms for complexity
- Apply various searching / sorting algorithms for solving real-world problems
- Implement List, Stack and Queue with appropriate data structures
- Work with binary trees and heap based priority queue
- Exploit the hashing technique and graph algorithms

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Asia, 2003.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, Second Edition, 1997.

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, "Data Structures and Algorithms", Pearson Education, New Delhi, 2006
2. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C", Orient Longman, Second Edition, 2008.
3. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw-Hill, New Delhi, Second Edition, 1991.

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20EE502OE **INDUSTRIAL AUTOMATION** **L T P C**
3 0 0 3

OBJECTIVES:

The students should be made to,

- Acquire knowledge on industrial automation systems
- Illustrate the field level equipments in industrial automation
- Develop basic programming with PLC
- Understand the theory and operation of SCADA system
- Design industrial application based problems

UNIT I INTRODUCTION **9**

Industrial control system – Automation and process control – Purpose of industrial automation – Industrial automation circuits – Computer based industrial control and automation – Architecture of the basic three level integrated industrial automation systems – Distributed control system.

UNIT II FIELD LEVEL EQUIPMENTS **9**

Sensors: Thermal overload relay – Proximity and photoelectric switch – Limit, level and flow switches – Temperature and pressure switch. Actuators: Electric motors – Pneumatic actuators – Micro Electro Mechanical System – Solenoid linear actuators – Different types of relays – Timers, Drum switches and special components – Pneumatic devices.

UNIT III PROGRAMMABLE LOGIC CONTROLLERS **9**

Introduction to PLCs – Modular construction of PLC – PLC I/O components – I/O modules – Special purpose of I/O modules – Central processing unit – PLC expansion and I/O configuration – Introduction to programming of PLCs – Basic programming instructions – PID control in the industry.

UNIT IV HMI AND SCADA **9**

HMI controls for data acquisition – Developer and runtime packages – Available tools – Definition of tags – Display of real time parameters in graphical form – Generation of various reports – Logging of alarms, trend curves and historical reports.

UNIT V COMMUNICATION PROTOCALS **9**

Serial and Parallel communication – Communication topology – Field bus and similar standards – RTU/MTU communications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Gain knowledge on the basics of industrial automation system
- Understand the working of different field level equipment's
- Analyze the theory and operation of PLC programming instructions
- Impart the knowledge of SCADA system
- Develop various industrial automation applications

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TEXT BOOKS:

1. Stamatios Manesis and George Nikolakopoulos, "Introduction to Industrial Automation", CRC Press, 2018.
2. Stuart A Boyer, "SCADA: Supervisory Control and Data Acquisition", 4th Edition, ISA Press, USA, 2009.

REFERENCES:

1. John W Webb Ronald A Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall India, 2003.
2. William Bolton, "Programmable Logic controllers", Elsevier, 6th Edition, 2015.
3. Gupta A K, "Industrial Automation and Robotics: An Introduction", Mercury Learning and Information, 2016.
4. Krishna Kant, "Computer based Industrial Control", 2nd Edition, Prentice Hall of India, 2010.
5. Popovic D and Bhatkar V P, "Distributed Computer Control for Industrial Automation", Marcel Dekkar Inc., Newyork, 1990.

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20IT501OE **FUNDAMENTALS OF OPERATING SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Acquire basic knowledge of operating system structures and its functioning
- Study the concept of process management
- Learn the basics of memory management
- Understand the structure of file systems
- Familiarize with different operating systems

UNIT I OPERATING SYSTEMS OVERVIEW **9**

Introduction to operating systems – Computer system organization - architecture – Operating system structure - operations – Process, memory, storage management – Open source operating systems – OS services – User interface – System calls – System programs – Process concept - scheduling – Operations on processes – Cooperating processes – Inter-process communication – Threads

UNIT II PROCESS MANAGEMENT **9**

Basic concepts – Scheduling algorithms – Algorithm evaluation – The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Deadlocks – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT III MEMORY MANAGEMENT **9**

Memory management – Swapping – Contiguous memory allocation – Paging – Segmentation - Virtual memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing

UNIT IV FILE MANAGEMENT **9**

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free space management – Disk scheduling – Disk management

UNIT V LINUX AND WINDOWS **9**

The Linux system – History – Process management – Scheduling – Memory management – File systems – Inter Process Communication - Windows OS - History – Design principles.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

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

- Identify the components of operating system and their functionalities
- Analyze the various process management algorithms
- Evaluate the performance of various memory management techniques
- Design a simple file system and analyze the performance
- Work with some popular operating systems like Linux, Windows

TEXTBOOK:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 8th Edition, 2011.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Addison Wesley, Second Edition, 2001.
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education, 1996.
3. D M Dhamdhere, "Operating Systems: A Concept-based Approach", Tata McGraw-Hill Education, Second Edition, 2007.
4. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hall, Seventh Edition, 2011.

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BoS (IT)

20IT502OE **INTRODUCTION TO DATABASE** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Correlate the role of database management systems in information technology applications
- Structure data using relational model
- Explore the features of structured query language
- Reduce the anomalies using Normalization
- Manage transaction and concurrency control techniques.

UNIT I DATABASE FUNDAMENTALS **9**

Purpose of Database Systems – View of Data - Database System Architecture – Database Users and Administrators – Data Models – Structure of Network Model – Structure of Hierarchical Model – Entity Relationship Model – Constraints – Removing Redundant Attributes in Entity Sets – E-R Diagrams - Design Issues – Extended E-R Features – Introduction of Relational Model – E-R Reduction to Relational Schemas

UNIT II RELATIONAL DATABASE MODEL **9**

Structure of Relational Databases – Database Schema – Schema Diagrams – Relational Query Languages - Relational Algebra – Tuple Relational Calculus –– Domain Relational Calculus

UNIT III STRUCTURED QUERY LANGUAGE **9**

Overview of SQL query language – SQL Data definition – Basic Structure of SQL Queries – Additional Basic Operations – Set Operations – Null values – Aggregate Operations – Nested Subqueries – Joins – Views – Integrity Constraints – Authorization. Introduction to Advanced SQL: Functions and Procedures – Triggers

UNIT IV NORMALIZATION **9**

Functional Dependencies – Non-loss Decomposition – Dependency Preservation - First, Second, Third Normal Forms – Boyce Codd Normal Form

UNIT V TRANSACTION AND CONCURRENCY CONTROL **9**

Transaction Model – ACID properties – Transaction States – Serializability - Conflict serializability – View Serializability – Testing Serializability. Concurrency Control – Lock Based Protocols – Deadlocks – Multiple Granularity – Time Stamp Based Protocols – Validation Based Protocols.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

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

- Draw the ER Diagram for enterprise applications
- Design databases using relational model
- Query the database using SQL
- Apply normalization techniques on the databases
- Perform transaction and concurrency control techniques.

TEXTBOOKS:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", McGraw Hill, Sixth Edition, 2011.
2. C.J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.

REFERENCE BOOKS:

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education/Addison Wesley, Sixth Edition, 2010.
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2004.

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20ME601OE	PRODUCTION TECHNOLOGY	L	T	P	C
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OBJECTIVES:

The student should be made to:

- Identify and select suitable materials for various engineering applications
- Understand the concept of metal casting process
- Know about the various types of welding processes
- Understand the working principles of machine tools such as Lathe, Shaping, Milling, Drilling and Grinding
- Learn about the basic 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 and weldability – Steels and Cast irons : Carbon steels – classifications based on percentage of carbon – properties and applications – Alloy steels: Stainless steel and tool steel.- Cast iron and its types.

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**

Centre lathe – Constructional features – Specifications – Operations performed – Special machines: Shaper, Drilling, Milling and Grinding machines – Constructional details and its operations.

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

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BoS (MECH)

OUTCOMES:

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

- Gain knowledge on engineering materials
- Know about the casting process and its defects
- Understand the construction and working principles of gas, arc welding and resistance welding process
- Identify the suitable machining process for the given component
- Describe the constructional and operational features of CNC machines

TEXT BOOKS:

1. Kalpakjian and Schmid, "Manufacturing Engineering and Technology", Pearson Education India, Edition, 2014.
2. Hajra Choudry S K, "Elements of Workshop Technology-Vol. II", Media Promoters and Publishers Pvt. Ltd, 2010.

REFERENCES:

1. Nagendra Parashar B S and Mittal R K, "Elements of Manufacturing Processes", Prentice Hall of India, 2011.
2. Rao P N, "Manufacturing Technology, Metal Cutting and Machine Tools", Tata McGraw Hill, New Delhi, 2013.
3. Chapman W A J, "Workshop Technology", Part I, II, III, E.L.B.S. and Edward Arnold Publishers Ltd, London, 2004.

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BoS (MECH)

20AD601OE	MACHINE LEARNING	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of Machine Learning (ML)
- Understand the methods of Machine Learning
- Know about the implementation aspects of machine learning
- Understand the concepts of Data Analytics and Machine Learning
- Understand and implement usecases of ML

UNIT I INTRODUCTION TO MACHINE LEARNING 8

Overview of Human Learning and Machine Learning, Types of Machine Learning, Applications of Machine Learning, Tools and Technology for Machine Learning.

UNIT II MACHINE LEARNING MODELING AND EVOLUATION 11

Machine Learning activities, Types of data in Machine Learning, Structures of data, Data quality and remediation, Data Pre-Processing: Dimensionality reduction, Feature subset selection.Selecting a Model: Predictive/Descriptive, training a Model for supervised learning, model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

UNIT III MACHINE LEARNING IN PRACTICE 9

Ranking - Recommendation System - Designing and Tuning model pipelines- Performance measurement - Azure Machine Learning - Open-source Machine Learning libraries - Amazon's Machine Learning Tool Kit: Sagemaker

UNIT IV OVERVIEW OF PROBABILITY IN MACHINE LEARNING 9

Selecting a Model: Predictive/Descriptive, Training a Model for supervised learning, model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

UNIT V APPLICATIONS OF MACHINE LEARNING 8

Image Recognition - Speech Recognition - Email spam and Malware Filtering - Online fraud detection - Medical Diagnosis.

TOTAL: 45 PERIODS

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BoS (AD)

OUTCOMES:

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

- Understand the basics of ML
- Explain various ZMachine Learning methods
- Demonstrate various ML techniques using standard packages.
- Explore knowledge on Machine learning and Data Analytics
- Apply ML to various real time examples

TEXT BOOKS:

1. Ameet V Joshi, "Machine Learning and Artificial Intelligence", Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D'Arcy, "Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies", MIT press, 2015.

REFERENCES:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer Publications, 2011.
2. Stuart Jonathan Russell, Peter Norvig, John Canny, "Artificial Intelligence: A Modern Approach", Prentice Hall, 2020.
3. John Paul Muller, Luca Massaron, "Machine Learning Dummies", Wiley Publications, 2021.

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BoS (AD)

20BM701OE BIOINFORMATICS **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the how to acquire the DNA and protein structure and sequence
- Study the database indexing, search and sequence formats
- Learn the different data processing tools and methods
- Know the various analysis methods and software tools
- Get an awareness about the applications of Bioinformatics

UNIT I BIOLOGICAL DATA ACQUISITION **9**

The form of biological information. Retrieval methods of DNA sequence, protein sequence and protein structure information

UNIT II DATABASES **9**

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases – primary sequence databases, protein sequence and structure databases, Organism specific databases

UNIT III DATA PROCESSING **9**

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus Global. Distance metrics. Similarity and homology.Scoring matrices.

UNIT IV METHODS OF ANALYSIS **9**

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman.Heuristic Methods of sequence alignment, FASTA, and PSI BLAST.Multiple Sequence Alignment and software tools for pairwise and multiple sequence alignment.

UNIT V APPLICATIONS **9**

Genome Annotation and Gene Prediction, ORF finding, Phylogenetic Analysis: Comparative genomics, orthologs, paralogs. Genome analysis – Genome annotation

TOTAL: 45 PERIODS

OUTCOMES:

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

- Appreciate the DNA and protein sequence data acquisition
- Realize the database indexing, searching and various file formats
- Do Access, search and retrieval processing on data
- Analyze different methods, algorithms and software tools
- Apply the skills in different findings and do the analysis on various applications

TEXT BOOKS:

1. Arthur M Lesk, "Introduction to Bioinformatics", Fourth Edition, Oxford University Press
2. Dan Gusfield, "Algorithms on Strings, Trees and Sequences", Cambridge University Press

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REFERENCE BOOKS:

1. Pierre Baldi, SorenBrunak, "Bioinformatics The Machine Learning Approach", MIT Press
2. Durbin R, Eddy S, Krogh A, Mitchison G, "Biological Sequence Analysis Probabilistic models of proteins and nucleic acids",Cambridge University Press, 1998
3. David Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, Second Edition
4. James D Tisdall, "Beginning Perl for Bioinformatics", O'Reilly Publisher

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20BM702OE FUNDAMENTALS OF NUTRITION **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Develop knowledge in the basic area of Food Chemistry
- Know how digestion takes place in Human and the insights of Mechanical and Chemical digestion
- Learn the Glycemic and Non Glycemic indexes of Carbohydrates
- Understand food processing and technology subjects effectively
- Appreciate the similarities and complexities of the chemical components in food

UNIT I OVERVIEW OF NUTRITION **9**

Definition, Six classes of nutrients, calculating energy values from food using the RDA, Nutritional status, Nutritional requirement, malnutrition, nutritional assessment of individuals and populations, dietary recommendations, Balanced diet planning: Diet planning principles, dietary guidelines; food groups, exchange lists, personal diet analysis

UNIT II DIGESTION **9**

Digestion, Absorption and Transport: Anatomy and Physiology: Anatomy and Physiology of the digestive tract, Mechanical and Chemical digestion, Absorption of Nutrients

UNIT III CARBOHYDRATES **9**

Glycemic and Non Glycemic carbohydrates, Blood glucose regulation, Recommendations of sugar intake for health, Health effects of fiber and starch intake, Artificial sweeteners; Importance of blood sugar regulation, Dietary recommendations for NIDDM and IDDM

UNIT IV PROTEINS AND LIPIDS **9**

Proteins; Food enzymes; Texturized proteins; Food sources, functional role and uses in foods. Review of structure, composition and nomenclature of Fats. Non-glyceride components in fats and oils; Fat replacements; Food sources, functional role and uses in foods. Health effects and recommended intakes of lipids.Recommended intakes of proteins, Deficiency – short term and long term effects.

UNIT V METABOLISM, ENERGY BALANCE AND BODY COMPOSITION **9**

Energy Balance, Body weight and Body composition, Health implications, Obesity, BMR and BMI Calculations, Weight control: Fat cell development, Hunger, Satiety and Satiation, Dangers of unsafe weight lost schemes, Treatment of obesity, Attitudes and behaviours toward weight control. Food and pharmaceutical grades, Toxicities, Deficiencies, Factors affecting bio availability, Stability under food processing conditions

TOTAL: 45 PERIODS

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BoS/BME

OUTCOMES:

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

- Describe the different classes nutrients
- Illustrate the digestion and absorption of Food substances
- Demonstrate the role of carbohydrates in producing the required energy
- Exhibit the energy balance and the body composition in detail
- Explain the significance of proteins and Lipids with its role

TEXT BOOKS:

1. Mann, Jim,Stewart Truswell, "Essentials of Human Nutrition", Third Edition, Oxford University Press, 2007.
2. Gibney, Michael J., et al, "Introduction to Human Nutrition", Second Edition, Blackwell, 2009.

REFERENCES:

1. Damodaran S, Parkin K L and Fennema O R, " Fennema's Food Chemistry Fourth Edition, CRC Press, 2008.
2. Belitz H D, Grosch W andSchieberle P, "Food Chemistry", Third Revised Edition, Springer, Verlag, 2004.

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20CE701OE ENVIRONMENTAL IMPACT ASSESSMENT **L T P C**

3 0 0 3

OBJECTIVES:

The student should be made to:

- Carry out developmental projects for environmental and social assessments.
- Explain Life Cycle Assessment and elements of waste minimization.
- Develop knowledge on various hazardous waste management.
- Learn industrial air emission control measures.
- Know about EIA for various infrastructure projects.

UNIT I INTRODUCTION **9**

Definition & Concept-Hierarchy in EIA – Initial Environmental Examination (IEE) – Environmental Impact Statement (EIS) – Environmental appraisal – Rapid and Comprehensive EIA, EIS, FONSI and NDS – Need for EIA Studies – Advantages and limitation of EIA.

UNIT II METHODOLOGIES AND CLEARANCE PROCEDURE **9**

Application Forms – Category of projects – Formation of EIA study team Methods of EIA – Criteria for selection of EIA methodology – Check lists – Matrices – Network – Overlays – Cost-benefits analysis – EIS format – Teams of Reference (ToR).

UNIT III ASSESSMENT AND PREDICTION **9**

Baseline data – Assessment of Impact on land, water, air, noise, social, cultural, flora and fauna – Mathematical models – Predictive measures – Resettlement & rehabilitation – Public participation in EIA – EIA case studies for select projects.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN **9**

Environment audit – Types of audit – Definitions and concepts – Stage of environmental audit – compliance schedule – Contents of EA report – Preparation of audit report – Introduction to ISO and ISO 14000 – Environmental monitoring plan.

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UNIT V LEGISLATIONAND CASE STUDIES 9

The Environmental Protection Act, The Water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act – Case studies and preparation of Environmental Impact assessment statement for various Industries.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Prepare and review environment impact assessment for various projects.
- Apply waste minimization strategies and waste reduction techniques.
- Reduce the generation of hazardous waste with proper disposal methods.
- Design industrial air emission control equipments with its standards.
- Apply EIA for various multi disciplinary projects.

TEXT BOOKS:

1. Gerard Kiely, "Environmental Engineering", Tata Mcgraw Hill Education Private Limited, New Delhi 2007.
2. Shukla S K and Srivastava P R, "Concepts in Environmental Impact Analysis",Common Wealth Publishers, New Delhi 2010.

REFERENCE BOOKS:

1. Canter R L, "Environmental Impact Assessment", McGraw Hill Inc, New Delhi, 2nd Edition 1996.

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20CE702OE BUILDING SERVICES **L T P C**

3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand how a building can be made comfortable and safe with the services designed and installed.
- Impart knowledge on basics of electrical wiring system.
- Recognize the importance of principles of illumination.
- Acquire awareness on various principles of refrigerant.
- Learn the principles on installation of fire safety components.

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 – Electric 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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UNIT V FIRE SAFETY INSTALLATION 9

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,

- Understand the special features in installation of lifts and escalators.
- Analyze basics of electricity distribution in buildings.
- Acquire knowledge about requirements of ventilation.
- Learn the principles of air conditioning and energy management system.
- Recognize the need for fire detection and protection.

TEXT BOOKS:

1. Roger Greeno and Fred Hall, "Building Services Handbook",Elsevier Publishers 4th Edition, 2007.

REFERENCE BOOKS:

1. Steffy G, "Architectural Lighting Design", John Wiley and Sons, 3rd Edition, 2008.
2. Killinger J and Killinger L, "Heating and Cooling Essentials", GoodheartWilcox Publishers, 2003.
3. Rao S and PSaluja H L,
4. "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1st Edition,2016.
5. Ashrae, "Fundamentals and Equipment", ASHRAE Inc.,Volume 4, 2005.

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20CS706OE	E-COMMERCE	L T P C
	(Common to AGE, BME, CIVIL, ECE, EEE and MECH)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study the basics of E-Commerce.
- Learn the activities involved in the E- commerce process.
- Focus the applications related to the EDI.
- Analyze the security issues in the E –commerce.
- Apply the E-commerce at various applications.

UNIT I INTRODUCTION **9**

E-Commerce framework – E-Business models – Network infrastructure for E-commerce – Internet as a Network Infrastructure – E-commerce and World Wide Web.

UNIT II E-COMMERCE **9**

Consumer oriented E-Commerce – Applications – Mercantile process models – Electronic Payment Systems – Digital Token based EPS – Smart cards – Credit cards – Risks – designing EPS – Study of e-commerce companies

UNIT III INTERORGANIZATIONAL COMMERCE AND EDI **9**

Electronic Data Interchange: EDI applications in Business – EDI and E-Commerce – EDI standardization and implementation – Internet based EDI.

UNIT IV SECURITY ISSUES IN E-COMMERCE **9**

Network Security – Client-Server Network Security – CS Security Threats – Firewalls – Data & Message Security – Encrypted Documents – Security on the Web.

UNIT V INTRAORGANIZATIONAL E-COMMERCE AND MARKETING **9**

Internal Information System-Work-flow Automation and Coordination-Supply Chain Management-Document Library-Types of Digital Documents-Corporate Data Warehouses – Advertising and Marketing on the Internet .

TOTAL: 45 PERIODS

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BoS (CSE)

OUTCOMES:

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

- Describe the basics of E-Commerce.
- Explain the activities involved in the E- commerce process.
- Develop the applications related to the EDI.
- Analyze the security issues in the E –commerce.
- Apply the E-commerce at various applications.

TEXT BOOKS:

1. Ravi Kalakota and Andrew B Whinston, "Frontiers of Electronic Commerce", Pearson Education Asia, 2009.

REFERENCES:

1. Marilyn Greenstein and Todd M Feinman ,"Electronic commerce: Security, Risk Management and Control", Tata McGraw-Hill , 2000.
2. Judy Strauss and Raymond Frost, "E Marketing", PHI, 2002.
3. Brenda Kienan, "Managing E Commerce Business", PHI, 2001.
4. Vivek Sharma and Rajiv Sharma, "Developing E Commerce Sites – an integrated approach", Pearson Education Asia, 2000.
5. Kamalesh K. Bajaj, "E-Commerce: The Cutting Edge & Business", Tata McGraw-Hill, 2003.

CHAIRMAN
BoS (CSE)

20EC701OE CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The students should be made to

- Understand the audio basics and devices
- Know the different audio systems
- Understand the various television systems
- Learn the operation of TV receivers and video systems
- Gain the knowledge on basics of home/office appliances

UNIT I AUDIO FUNDAMENTALS AND DEVICES **9**

Basic characteristics of sound signal: level and loudness - pitch - frequency response - fidelity and linearity - Reverberation - Audio level metering - decibel level in acoustic measurement - Microphone: working principle - sensitivity - nature of response - directional characteristics - Types: carbon - condenser - crystal - electrets - tie-clip - wireless - Loud speaker: working principle - characteristic impedance - watt capacity - Types: electrostatic - dynamic - permanent magnet etc - woofers and tweeters - Sound recording: Optical recording - stereophony and multichannel sound - MP3 standard.

UNIT II AUDIO SYSTEMS **9**

Audio system: CD player, home theatre sound system, surround ,sound- Digital console: block diagram, working principle, applications - FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T - PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification

UNIT III TELEVISION SYSTEMS **9**

Monochrome TV standards - scanning process - aspect ratio - persistence of vision and flicker - interlace scanning - picture resolution - Composite video signal: horizontal and vertical sync details - scanning sequence - Colour TV standards - colour theory - hue-brightness - saturation - luminance and chrominance - Different types of TV camera - Transmission standards:PAL system - channel bandwidth.

UNIT IV TELEVISION RECEIVERS AND VIDEO SYSTEMS **9**

PAL-D colour TV receiver - block diagram - Precision IN Line color picture tube - Digital TVs: LCD - LED - PLASMA - HDTV - 3D TV - projection TV - DTH receiver - Video interface: Composite - Component - Separate Video - Digital Video - SDI - HDMI Multimedia Interface - Digital Video Interface - CD and DVD player: working principles - interfaces.

UNIT V HOME / OFFICE APPLIANCES **9**

FAX and Photocopier - Microwave Oven: types - single chip controllers - wiring and safety instructions - technical specifications - Washing Machine: wiring diagram - electronic controller for washing machine – technical specifications - types of washing machine - fuzzy logic - Air conditioner and Refrigerators: Components features - applications - and technical specification - Digital camera and cam coder: pick up devices - picture processing - picture storage.

Total: 45 Periods

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BoS/ECE

OUTCOME:

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

- Develop audio circuits
- Familiarize with audio systems
- Familiarize with TV systems
- Fault identification inTV
- Familiarize in home/office appliances

TEXT BOOKS:

1. Bali S.P, "Connsumer Electronics", Pearson Education India, 2010 , Latest Edition.
2. Bali R and Bali S.P, "Audio Video Systems: Principle Practices & Troubleshooting", Khanna Book Publishing Co.(P) Ltd., Delhi, India, Latest Edition, 2010.

REFERENCES:

1. Gulati R.R, "Modern Television Practices", New Age International Publication (P) Ltd. New Delhi Year 2011, Latest Edition
2. Gupta R.G, "Audio Video Systems", Tata McGraw Hill, New Delhi, India 2010, Latest Edition
3. Whitaker Jerry & Benson Blair, "Mastering Digital Television", McGraw-Hill Professional, Latest Edition, 2010.
4. Whitaker Jerry & Benson Blair, "Standard Handbook of Audio Engineering", McGraw-Hill Professional, Latest Edition, 2010.

Chairman
BoS/ECE

20EC702OE **RFID AND FLEXIBLE SENSORS** **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basic principle of RFID system.
- Get knowledge on information processing through RFID system
- Learn the basics of readers, printers and protocols.
- Design for various applications testing software.
- Understand the principle and applications of flexible sensors

UNIT I INTRODUCTION AND RFID ARCHITECTURE **9**

Case for RFID - Eras of RFID - applications - RFID Architecture - confluence of technologies - key functionalities- system components - systemic quality considerations - architecture guidelines - System Management.

UNIT II TAGS AND PROTOCALS **9**

Basic tag capabilities - physical characteristics - power source - air interface - information storage and processing capacity - standards - protocol terms and concepts - how tags store data - singulation and anti-collision procedurestag features for security and privacy - learn to troubleshoot tag communications

UNIT III READERS, PRINTERS AND READER PROTOCOLS **9**

Physical and logical components of RFID reader - parts of RFID printer and applicator - types of readers - layout for readers and antennas - configuring readers - parts of a reader protocol - vendor protocols - EPC global protocol overview - simple lightweight RFID reader protocol - future protocols.

UNIT IV MIDDLEWARE AND INFORMATION SERVICE **9**

Motivations - logical architecture - application level events specification - commercial RFID middleware - RFID Data - EPC global network - object naming service - EPC information services.

UNIT V FLEXIBLE SENSORS **9**

World of wearables - Attributes of wearables - Textiles and clothing: The meta wearable - Challenges and opportunities - Future of wearables - Need for wearable haptic devices - Categories of wearable haptic.

TOTAL: 45 PERIODS

Chairman
BoS/ECE

OUTCOMES:

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

- Understand the principle of operation of various components of RFID system.
- Familiar with usage of tags and protocols
- Explain about the working principle of readers, printers and reader protocols
- Apply the methodology in engineering applications like inventory management, material handling etc
- Know about the recent trends in flexible sensors

TEXT BOOK:

1. Himanshu Bhatt, Bill Glover, "RFID Essentials", O'Reilly Media publications, 2006 Approved by third Academic council.
2. Amin Rida and Manos M. Tentzeris, RFID-Enabled Sensor Design and Applications (Artech House Integrated Microsystems), 2011, 1st edition, Artech House Publishers, UK

REFERENCES:

1. Klaus Finkenzeller, "RFID Handbook", John Wiley & Sons, Ltd, 2010
2. Stephen B. Miles, Sanjay E. Sarma, John R. Williams, "RFID Technology and Applications", Cambridge University Press, 2008
3. Patrick J Sweeney, "RFID for DUMMIES", Wiley India Publications, 2005
4. Elaine Cooney, "RFID + The Complete review of Radio Frequency Identification", 1st ed., Delmar Cengage Learning 2007.

Chairman
BoS/ECE

20IT701OE	PROGRAMMING IN JAVA	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the fundamentals of object oriented programming in Java.
- Be familiar with the Object Oriented concepts in Java
- Be exposed to the usage of Arrays in Java programming
- Understand the mechanism in handling exceptions, Multithreading and I/O.
- Demonstrate the concepts of AWT, event handling used in GUI.

UNIT I INTRODUCTION **9**

Introduction to Java – History of Java – FOP versus OOP – OOOPs Concepts - Java Programming Paradigm – Features of Java Programming – Java Programming Environment – C vs Java - Tools available for Java Programming – Java Architecture - Data types and Character set – Variables - Identifiers – Keywords – Operators - A Simple Java Program – Analysis of the program – Command line input in Java – Input using Scanner class

UNIT II CLASS, OBJECT and INHERITANCE **9**

Class – Class Structure – Object declaration – Object Initialization - Declaring Multiple Classes - Adding methods to Class – Constructor – this Keyword – Multiple Constructors – Constructor Overloading - Control Statements – Inheritance – Method Overriding – Super Keyword – Abstract Class– final Keyword – Access Modifiers - Packages in Java – Interface – Iterator – Cloneable – Serializable – Comparable

UNIT III ARRAYS **9**

Array in Java: Creation of Array – Storing elements in Array – Processing elements in Array – 2D Array and 3D Array – Java Scope – Static Keyword – Static Variable – Static Method – Nested Class – Recursion

UNIT IV EXCEPTION HANDLING, MUTITHREADING AND I/O STREAMS **9**

Exception Handling - Multithreading –Thread – Life Cycle of Thread – Thread Control Methods – Thread Types – Thread Scheduling – Thread Synchronization - I/O Stream – Character Stream Class - Data Input Stream – Data Output Stream – File Handling - Java networking - JDBC - Connectivity

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UNIT V APPLET, AWT and SWING 9

Java Applet Programming : Applet – Building an applet – Hosting an applet – Running an Applet – Basic Structure of an applet – Basic Methods in applet – Input passing to an Applet – Application Versus Applet – Applet Events – Basics of HTML – Applet Tag Properties - AWT Programming – Classes of AWT – Components – Methods – Containers – Event Handling – Classes – Interfaces - SWING: Introduction – Swing Components – Containers – Events - Hierarchy of Swing class

OUTCOMES:

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

- Explain the fundamentals of Java programming
- Use the concept of object oriented programming in Java
- Implement the mechanism of array and recursion.
- Develop applications for concurrent processing and I/O with exception handling.
- Build interactive GUI applications in Java programming

TEXT BOOK:

1. Hebert Schildt, "Java: The Complete Reference, Eleventh Edition", 7th Edition, McGraw-Hill, 2010.

REFERENCE(S):

1. Kathy Sierra, Bert Bates, "Head First Java", 2nd Edition, O'Reilly Media, Inc., 2005.
2. Y.Daniel Liang, "Introduction to Java Programming", 11th Edition, Pearson Education, 2017.
3. https://onlinecourses.nptel.ac.in/noc21_cs56/preview

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BoS (IT)

20EE702PE	INDUSTRIAL SAFETY ENGINEERING	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- Know the basics of industrial safety engineering
- Identify the various safety assessment techniques
- Analyze the various safety quantifications.
- Understand the concepts of various safety analysis techniques
- Learn the health and safety management system

UNIT I INTRODUCTION **9**

Introduction to Industrial safety Engineering – Key concepts and terminologies – Key concepts and terminologies – Safety domain ontology – Risk assessment and control – Safety Engineering and accident causing mechanisms – Preliminary hazard list and analysis – Hazard and Operability study (HAZOP) – Failure Modes and Effects Analysis (FMEA) – Identification of failure modes – Failure modes and effects analysis – Application of hazard identification techniques – Fault Tree Analysis (FTA) – Construction, gate by gate method, Cut-set method and importance measures – Event Tree Analysis (ETA).

UNIT II SAFETY ASSESSMENT **9**

BOWTIE TOOL – Bow–tie: Common cause cut sets, cut-sets for accident scenarios, Identification of safety barriers – Risk assessment – Consequence assessment – Energy control model and hazard control hierarchy – Safety function deployment – Ranking of design solutions: AHP approach – Quantification of basic events for non-repairable components, Hazard rate, Exponential distribution and Weibull distribution.

UNIT III SAFETY VS RELIABILITY **9**

Quantification of basic events: Failure to repair process, Combined process, Failure and repair intensities – Computation of combined process parameters: Laplace transform analysis and Markov analysis – Quantification of systems safety and reliability block diagram – Systems safety quantification: Truth table approach, Structure function, Minimal cut and Minimal path representation using structure function – Systems safety quantification: Tutorial.

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BoS/EEE

UNIT IV SAFETY ANALYSIS **9**

Human error, Classification and causes, Identification and human reliability assessment and human error quantification from experts opinions fuzzy set approach – Accident investigation, Accident investigation and analysis: Descriptive analytics, Control chart analysis, Regression and Classification Tree.

UNIT V OSHAS 18001 AND OSHMS **9**

Occupational Health and Safety Management Systems (OH&SMS) and OHSAS 18001 – Safety performance indicators – Energy isolations – Virtual Reality(VR) – Introduction – Geometry of virtual world – VR roadmap a case study.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Elucidate the basic concepts of industrial safety engineering
- Discuss the various safety assessment methods
- Identify the various safety quantifications.
- Compare various methods for accident analysis
- Understand the concepts of health and safety management systems

TEXT BOOK:

1. Komamoto and Henley, "Probabilistic Risk Assessment for Engineering and Scientists", IEEE Press, 1995.

REFERENCES:

1. H. W. Heinrich, Dan Petersen, Nestor Roos, "Industrial Accident Prevention", 5th Edition, McGraw Hill, New York, 1980.
2. Petersen and Dan, "Techniques for Safety Management - A Systems Approach" Amer Society of Safety Engineers (2003)

Chairman
BoS/EEE

20AD701OE INTRODUCTION TO ARTIFICIAL INTELLIGENCE **L T P C**
3 0 0 3

OBJECTIVES:

The objective of this course is to enable the students to,

- Understand the basic concepts of intelligent agents
- Develop general-purpose problem-solving agents, logical reasoning agents, and agents that reason under uncertainty
- Employ AI techniques to solve some of today's real-world problems
- Understand the different ways of designing software agents
- Learn to represent knowledge in solving AI problems

UNIT I INTELLIGENT AGENTS **9**

Introduction to AI - Agents and Environments - Concept of rationality - Nature of environments - Structure of agents Problem solving agents - search algorithms - uninformed search strategies.

UNIT II PROBLEM SOLVING **9**

Heuristic search strategies - heuristic functions Local search and optimization problems - local search in continuous space - search with nondeterministic actions - search in partially observable environments - online search agents and unknown environments.

UNIT III GAME PLAYING AND CSP **9**

Game theory - optimal decisions in games - alpha-beta search - monte-carlo tree search - stochastic games - partially observable games Constraint satisfaction problems - constraint propagation - backtracking search for CSP - local search for CSP - structure of CSP.

UNIT IV LOGICAL AGENTS **9**

Knowledge-based agents - propositional logic - propositional theorem proving - propositional model checking - agents based on propositional logic First-order logic - syntax and semantics - knowledge representation and engineering - inferences in first-order logic - forward chaining - backward chaining - resolution

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UNIT V KNOWLEDGE REPRESENTATION AND PLANNING 9

Ontological engineering - categories and objects - events - mental objects and modal logic - reasoning systems for categories - reasoning with default information Classical planning - algorithms for classical planning - heuristics for planning - hierarchical planning - non-deterministic domains - time, schedule, and resources – analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings
- Choose appropriate algorithms for solving given AI problems
- Design and implement logical reasoning agents
- Design software agents to solve a problem
- Design and implement agents that can reason under uncertainty

TEXT BOOK:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

REFERENCES:

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B, "Artificial Intelligence", McGraw Hill, 2008.
3. Patrick H Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006;
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013. (http://nptel.ac.in/)
5. Dennis Rothman, "Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases", 2018.

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BoS (AD)

20IT702OE	WEB DESIGN	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Enhance the knowledge of how to develop a Web page using HTML
- Classify the various style and dimensions of CSS
- Design the web page using JavaScript
- Design the web page using DOM
- Implement the various approach of database connectivity

UNIT I INTRODUCTION **9**

Introduction to HTML – Benefits of HTML – Structure of an HTML Document, HTML Tags: Attributes – meta Elements – Linking – Lists- Tables- Forms- Form Elements- Form Attributes – Web services.

UNIT II CASCADING STYLE SHEETS **9**

Introduction to CSS - Inline Styles – Conflicting Styles- Style Sheets- Positioning Elements – Backgrounds –Dimensions- Text Flow- Media Types – Drop-Down Menu.

UNIT III SCRIPTING LANGUAGE **9**

Introduction to Scripting Language – Data Types - Variables – Expressions – Operators and Control Statements – Arrays – User Defined Functions – Events.

UNIT IV JAVASCRIPT OBJECTS **9**

JavaScript Objects: String – Math – Date – Boolean and Number – Window – Document – Document Object Model(DOM) – DOM Collections – Dynamic Styles.

UNIT V IMPLEMENTATION STRATEGIES **9**

Introduction to PHP: Basics – String Processing and Regular Expressions – Form Processing and Business Logic – Connecting to a Database – Using Cookies – Dynamic Content – Operator Precedence Chart – Database Connectivity: SQL: DDL – DML- MySQL: Creating Database in MySQL – Mini Project.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

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

- Identify different types of HTML tags, their functionality and attributes and learn the basics of web services
- Classify CSS to control the appearance of web pages and denote the background elements and media types
- Incorporate JavaScript variables, operators and functions in web pages and manipulate HTML forms to validate user inputs
- Demonstrate various JavaScript object models and create a web pages with dynamic style using JavaScript and DOM
- Demonstrate the database connectivity and simple PHP application program using web Server

TEXT BOOKS:

1. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web: How to Program", 5th Edition, Pearson, 2011
2. KoGent Learning Solutions Inc., "Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and AJAX", Kindle Edition, Dreamtech Press, 2012.

REFERENCES :

1. Robert. W. Sebesta, "Programming the World Wide Web", 8th Edition, Pearson Education, 2015.
2. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 2007.
3. http://www.w3schools.com/

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BoS (IT)

20ME701OE	BASICS OF HYDRAULIC AND PNEUMATIC SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Students should be made to:

- Study the fundamentals of fluid power systems
- Understand the working of hydraulic pumps and actuators
- Know about control valves and accumulators in hydraulic systems
- Learn the various components of pneumatic and electro-pneumatic systems
- Identify the various trouble shoots in hydraulic and pneumatic systems

UNIT I FUNDAMENTALS OF FLUID POWER SYSTEMS **9**

Introduction – fluid power systems – types – components – properties of fluids – types of fluids – applications of Pascal's law – principle of hydraulic flow - laminar and turbulent flow – Reynolds's number – Darcy's equation – losses in valves and fittings – advantages and applications of fluid power – fluid power ANSI symbols.

UNIT II HYDRAULIC PUMP AND ACTUATORS **9**

Principles of hydraulic system – pumping theory – pump classification - gear pump, vane pump, piston pump – fluid power actuators – linear hydraulic actuators - single acting, double acting and special type – rotary actuators - gear, vane and piston motors – hydraulic cushioning.

UNIT III CONTROL COMPONENTS IN HYDRAULIC SYSTEMS AND ACCUMULATORS **9**

Directional Control Valve (DCV) - check valve, 3/2 DCV and 4/3 DCV – pressure control valve - pressure relief valve and pressure reducing valve – flow control valve - pressure compensated and non pressure compensated – mechanical servo valves – proportional valves – comparison of servo and proportional valve – accumulators – types - weight loaded, spring loaded and gas loaded accumulators – intensifier – intensifier press circuit.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS **9**

Principles of pneumatic system – properties of air – compressors – Filter, Regulator and Lubricator (FRL) unit – muffler – air control valves – pneumatic actuators – components of electrical control - switches, solenoids, relays and timers – electro pneumatic system - electro pneumatic circuits - reciprocation, sequencing and regenerative – introduction to fluidics.

UNIT V TROUBLE SHOOTING AND APPLICATIONS **9**

Hydraulic and pneumatic systems: Installation, selection, maintenance, troubleshooting and remedies – low cost automation – Case studies: Conveyor feed system, car parking barriers, pick and place robot.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the basic concepts of fluid power systems
- Describe the functions of various hydraulic pump and actuators
- Familiarize with different types of control valves and accumulators
- Understand the functions of pneumatic and electro pneumatic systems

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BoS (MECH)

- Analyse the various trouble shooting methods of hydraulic and pneumatic systems

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education India, 7th Edition, 2013.
2. Srinivasan R, "Hydraulic and Pneumatic Controls", Vijay Nicole, 3rd Edition, 2019.

REFERENCES:

1. Majumdar S R, "Oil Hydraulics Systems-Principles and Maintenance", Tata McGraw Hill, 2017.
2. Majumdar S R, "Pneumatic Systems-Principles and Maintenance", Tata McGraw Hill, 1st Edition, 2011.
3. Shanmugasundaram K, "Hydraulic and Pneumatic Controls", S.Chand & Co, 1st Edition, 2006.

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BoS (MECH)

20M101 **FINANCIAL MANAGEMENT**

(Common to all Branches)

L T P C

3 0 0 3

OBJECTIVES:

The student should be made to:

- Acquire 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 etc

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.

45 PERIODS

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BoS (IT)

COURSE 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

CHAIRMAN
BoS (IT)

20M102 **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**

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the 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 capitalisation models, and 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.

45 PERIODS

CHAIRMAN
BoS (IT)

COURSE 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, 14th Edition, 2019.

REFERENCES:

1. Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, 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 Edition(SIE), 2019

CHAIRMAN
BoS (IT)

20M103 **BANKING, FINANCIAL SERVICES AND INSURANCE**

(Common to all Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Study about the Banking system in India.
- Acquire 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 & 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– Asset and 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 –The 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.

45 PERIODS

CHAIRMAN
BoS (IT)

COURSE 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

1. 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.

CHAIRMAN
BoS (IT)

20M104 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS

(Common to all Branches)

L	T	P	C
3	0	0	3

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: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - 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 - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), 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 – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT V EMERGING TRENDS 9

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

45 PERIODS

CHAIRMAN
BoS (IT)

COURSE 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, Packt Publishing, 2nd Edition, 2018

REFERENCES:

1. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018
2. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.

CHAIRMAN
BoS (IT)

20M105 **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 - Cryptocurrencies and Applications, block chain, Artificial Intelligence, machine learning. Fintech users, Individual Payments, RTGS Systems, Immediate Page 54 of 90 Payment Service (IMPS), Unified Payments Interface (UPI).Legal and Regulatory Implications of Crypto currencies, 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, and Technology Issues

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE **9**

A Brief 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 and Underwriting Innovations in Insurance Services.

UNIT IV PEER TO PEER LENDING **9**

P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding Crowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations.

UNIT V REGULATORY ISSUES **9**

FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: StartupsRegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection.

45 PERIODS

CHAIRMAN
BoS (IT)

COURSE 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

1. Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, Createspace Independent Publishing Platform,2016.

REFERENCES:

1. Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019.
2. Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016.
3. Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016.
4. IIBF, Digital Banking, Taxmann Publication, 2016.
5. Jacob William, Financial Technology, Create space Independent Pub, 2016.
6. Luke Sutton, Financial Technology: Bitcoin & Blockchain, Createspace Independent Pub, 2016.

CHAIRMAN
BoS (IT)

20M106 **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 **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, recent developments in FinTech, future prospects and potential issues with Fintech.

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, Payday lending, Microfinance, Crowdfunding.

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, On-Demand 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 and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial institutions collaborating with FinTech companies, The new financial world.

UNIT V FUTURE OF FINTECH **9**

How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

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BoS (IT)

45 PERIODS

COURSE 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

1. Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015

REFERENCES:

1. Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016.
2. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016.
3. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018.
4. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020.
5. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018.

CHAIRMAN
BoS (IT)

20M201 **FOUNDATIONS OF ENTREPRENEURSHIP** L T P C
(COMMON TO ALL BRANCHES) 3 0 0 3

OBJECTIVES:

The Students should be made to:

- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs
- To develop and strengthen the entrepreneurial quality and environment
- To apply the principles and theories of entrepreneurship and management in Technology oriented business
- To empower the learners to run a Technology driven business efficiently and effectively
- To enhance knowledge on emerging trends in entrepreneurship

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.

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

CHAIRMAN
BoS (MECH)

OUTCOMES:

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

- Learn the basics of Entrepreneurship
- Understand the business ownership patterns and environment
- Get awareness of the Job opportunities in Industries relating to Technopreneurship
- Know various applications of technopreneurs and successful technopreneurs
- Acquaint with the recent and emerging trends in entrepreneurship

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, 11th Edition, 2019.

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, 2007.
3. Lang J, "The High Tech Entrepreneur's Handbook", Ft.com, 2002.
4. David Sheff, "China Dawn: The Story of a Technology and Business Revolution", 2002.
5. Dennis Posadas, "JumpStart: A Technopreneurship Fable", Pearson Prentice Hall, 2009.
6. Frederico Gonzales and Barcelon M, "Basics of Technopreneurship: Module 1.1-1.2", President-PESO Inc; UP.

CHAIRMAN
BoS (MECH)

20M202	TEAM BUILDING AND LEADERSHIP MANAGEMENT FOR BUSINESS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Students should be made to:

- To develop and strengthen the teams and to know the basic concepts
- To apply the principles and theories of Team Building in managing Technology oriented businesses
- To impart the Leadership skills and traits essential to become successful entrepreneurs
- To learn various leadership styles and theories for business development
- To empower the learners to build robust teams for running and leading a business efficiently and effectively

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 Behaviors - 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

CHAIRMAN
BoS (MECH)

OUTCOMES:

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

- Learn the basics of managing teams for business
- Understand the techniques for developing effective teams for business management
- Know the fundamentals of leadership for running a business
- Apply various leadership styles and theories for business development
- Acquaint with emerging trends in leadership effectiveness for entrepreneurs

TEXT BOOKS:

1. Hughes R L, Ginnett R C, and Curphy G J, "Leadership: Enhancing the Lessons of Experience", McGraw Hill Education, India, 9th 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, 2015.
3. Daniel Levi, "Group Dynamics for Teams", Sage Publications, 4th Edition, 2014.
4. Dyer W G, Dyer Jr W G, and Dyer J H., "Team Building: Proven Strategies for Improving Team Performance", Jossey-Bass, 5th Edition, 2013.

CHAIRMAN
BoS (MECH)

20M203	CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Students should be made to:

- Develop the creativity skills among the learners
- Impart the knowledge of creative intelligence essential for entrepreneurs
- Know the applications of innovation in entrepreneurship
- Learn the concepts of innovation and entrepreneurship
- Apply innovative business models for business

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.

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

CHAIRMAN
BoS (MECH)

OUTCOMES:

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

- Learn the basics of creativity for developing Entrepreneurship
- Know the importance of creative intelligence for business growth
- Understand the advances through Innovation in Industries
- Apply the applications of innovation in building successful ventures
- Acquaint with developing innovative business models to run the business efficiently and effectively

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", 4th 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, 2010.
4. Dale Timpe, "Creativity", Jaico Publishing House, 2nd Edition, 2003.
5. Brian Clegg, Paul Birch, "Creativity", Kogan Page Limited, 7th Edition, 2009.
6. Geoff Love and Raj Echambadi's., "Strategic Innovation: Building and Sustaining Innovative Organizations", Coursera.

CHAIRMAN
BoS (MECH)

20M204	PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Students should be made to:

- Provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs
- Provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners
- Give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners
- Understand the strategies in product promotion and distributions
- Analyze the issues in marketing management

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.

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

CHAIRMAN
BoS (MECH)

OUTCOMES:

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

- Get the awareness of marketing management process
- Understand the marketing environment
- Acquaint about product and pricing strategies
- Gain Knowledge of promotion and distribution in marketing management
- Comprehend the contemporary marketing scenarios and offer solutions to marketing issues

TEXT BOOKS:

1. Sherlekar S A, "Marketing Management", Himalaya Publishing House, 2016.
2. Philip Kotler and Kevin Lane Keller, "Marketing Management", 15th Edition, Pearson, 2015.

REFERENCES:

1. Vijay Prakash Anand, "Marketing Management: An Indian Perspective", Biztantra, 2nd Edition, 2016.
2. Ramaswamy V S and Namakumari S, "Marketing Management: Global Perspective, Indian Context", Macmillan Publishers India, 5th Edition, 2015.
3. Kazmi S H H., "Marketing Management", Excel Books India, 2013.
4. Dr. Gupta C B and Dr. Rajan Nair N, "Marketing Management: Text and Cases", 17th Edition, 2016.

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BoS (MECH)

20M205	HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Students should be made to:

- Introduce the basic concepts, structure and functions of human resource management for entrepreneurs
- Understand the methods and techniques followed by Human Resource Management practitioners
- Create an awareness of the roles, functions and functioning of human resource department
- Gain knowledge on training and development of employees
- Empower the learners stronger in controlling the human resources

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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BoS (MECH)

OUTCOMES:

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

- Understand the Evolution of HRM and Challenges faced by HR Managers
- Learn about the HR Planning Methods and practices
- Acquaint about the Recruitment and Selection Techniques followed in Industries
- Known about the methods of Training and Employee Development
- Comprehend the techniques of controlling human resources in organisations

TEXT BOOKS:

1. Gary Dessler and Biju Varkkey, "Human Resource Management", Pearson, 14th Edition, 2015.
2. Mathis and Jackson, "Human Resource Management", Cengage Learning, 15th Edition, 2017.

REFERENCES:

1. David A Decenzo, Stephen P Robbins, and Susan L Verhulst, "Human Resource Management", Wiley, International Student Edition, 2014.
2. Wayne Mondy R, "Human Resource Management", Pearson, 2015.
3. Luis R Gomez-Mejia, David B Balkin, Robert L Cardy, "Managing Human Resource", PHI Learning, 2012.
4. John M Ivancevich, "Human Resource Management", McGraw Hill Irwin, 12th Edition, 2013.
5. Aswathappa K, Sadhna Dash, "Human Resource Management - Text and Cases", McGraw Hill, 9th Edition, 2021.
6. Uday Kumar Haldar, Juthika Sarkar, "Human Resource Management", Oxford, 2012.

CHAIRMAN
BoS (MECH)

20M206	FINANCING NEW BUSINESS VENTURES (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Students should be made to:

- Impart the knowledge essential for entrepreneurs for financing new ventures
- Develop the basics of business venture financing
- Acquaint the learners with the sources of debt and equity financing
- Know the learners with sources of equity financing
- Empower the learners towards fund raising for new ventures effectively

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

OUTCOMES:

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

- Learn the basics of starting a new business venture
- Understand the basics of venture financing
- Know the sources of debt financing
- Understand the sources of equity financing
- Acquaint with the methods of fund raising for new business ventures

CHAIRMAN
BoS (MECH)

TEXT BOOKS:

1. Brealey and Myers., "Principles of Corporate Finance", McGraw Hill Education (India) Private Limited, 12th Edition, 2018.
2. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw Hill Education India Pvt Ltd, New Delhi, 2019.

REFERENCES:

1. Andrew Fight., "Introduction to Project Finance". Butterworth-Heinemann, 2006.
2. Andrew Metrick and Ayako Yasuda., "Venture Capital and the Finance of Innovation", John Wiley and Sons, Inc, 2nd Edition, 2010.
3. Brad Feld and Jason Mendelson., "Venture Deals", John Wiley & Sons, Inc., 3rd Edition, 2016.
4. John May and John Simons, "Every Business Needs an Angel: Getting the Money You Need to Make Your Business Grow", Crown Business, 2001.
5. Paul Alan Gompers and Joshua Lerner, "The Money of Invention: How Venture Capital Creates New Wealth", Harvard Business Press, 2001.
6. Justin J. Camp, "Venture Capital Due Diligence: A Guide to Making Smart Investment Choices and Increasing Your Portfolio Returns", John Wiley & Sons, 2002.
7. Thomas Byers, "Technology Ventures: From Idea to Enterprise", McGraw Hill Higher Education, 2014.
8. Josh Lerner, Ann Leamon, and Felda Hardymon, "Venture Capital, Private Equity, and The Financing of Entrepreneurship", 2012.

CHAIRMAN
BoS (MECH)

20M301	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 **9**

1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration

UNIT-II **9**

1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT-III **9**

1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT-IV **9**

1. Bureaucratic Approach: Max Weber
2. Human Relations Approach : Elton Mayo
3. Ecological Approach : Riggs

UNIT-V **9**

1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers
3. Decision Making: Decision Making - Types, Techniques and Processes.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the role of public administration.
- Represent functions of administration.
- Provide the relationships and approaches in administration
- Idea about the bureaucratic and ecological approaches.
- Implement the leadership approaches, communication types and decision making process.

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.

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BOS/ECE

20M302	ELEMENTS OF PUBLIC ADMINISTRATION	L T P C
	(COMMON TO ALL BRANCHES)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the nature of administration in modern society
- Learn the relationships with social science.
- Learn about the organization functions and its types.
- Understand the behavior of chief executive and its role.
- Know about the personnel administration and developing society

UNIT I **9**

Administration in Modern Society; Pubic and Private administration; Evolution of the study of Public Administration. Concept of good governance.

UNIT II **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 **9**

Principles of Organisations : Hierarchy, Unity of command, Span of control, Coordination, Centralisation, Decentralisation, Authority and Responsibility; Formal and Informal Organisation.

UNIT IV **9**

Chief Executive, Line and Staff, Supervision, Delegation, Leadership, Communication, Decision making , Morale and Motivation .

UNIT V **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,

- Cope up with modern society.
- Maintain a good relationship with social.
- Understand the organization functions.
- Behaves as a good chief for subordinates.
- Get a idea about chief executive and follow a good code of conduct.

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REFERENCES:

1.John Pfiffiner and Robert Presthus.: Public Administration

2. Dimock & Dimock : Public Administration

3. Terry : Principles of Management

4. John D. Millet : Management in Public Services.

5. E.N. Gladden : Essentials of Public Administration

6. M.P. Shrama : Principle & Practices of Pub. Admn.,Kitab Mahal, Allahabad . Crozior M : The Bureaucratic phenomenon (Chand)

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BOS/ECE

20M303	PUBLIC PERSONNEL ADMINISTRATION (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the nature of personnel administration.
- Learn the different relationships and integrity in administration.
- Understand the recruitment process and training methods
- Understand the different services in public administration.
- Knowledge about employer employee relations

UNIT-I **9**

1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

UNIT-II **9**

1. Generalist Vs Specialist
2. Civil Servants' Relationship with Political Executive
3. Integrity in Administration.

UNIT-III **9**

1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

UNIT-IV **9**

1. All India Services
2. Service Conditions
3. State Public Service Commission

UNIT-V **9**

1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Execute a perfect personnel administration.
- Idea about the different relationships and integrity in administration.
- Know the recruitment process and training methods
- Prepare for the different services in public administration.
- Maintain a good relation with employer.

REFERENCES:

1. Stahl Glean O: Public Personnel Administration
2. Parnandikar Pai V.A: Personnel System for Development Administration.
3. Bhambhiru . P: Bureaucracy and Policy in India.
4. Dwivedi O.P and Jain R.B: India's Administrative state.
5. Muttalis M.A: Union Public Service Commission.
6. Bhakara Rao .V: Employer Employee Relations in India.
7. Davar R.S. Personnel Management & Industrial Relations
8. Rumki Basu: Public Administration:Concept and Theories, New Delhi:Sterling, 2013.
9. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

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BOS/ECE

20M304	ADMINISTRATIVE THEORIES (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the identity of public administration.
- Learn the different models of organization and relationships.
- Understand the organizational goal and design
- Understand the different theoris of motivation and laederships in public administration.
- Knowledge about different administrative thinkers

UNIT I **9**

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as adiscipline and Identity of Public Administration

UNIT II **9**

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

UNIT III **9**

Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.

UNIT IV **9**

Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making

UNIT V **9**

Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Know the identity of public administration.
- Knowledge about the different models of organization and relationships.
- Get clear idea of the organizational goal and design
- Knowledge about the different theories of motivation and leaderships in public administration.
- Analyze the different administrative thinkers idea to implement

REFERENCES:

1. Crozior M : The Bureaucratic phenomenon (Chand)
2. Blau. P.M and Scott. W : Formal Organizations (RKP)
3. Presthus. R : The Organizational Society (MAC)
4. Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
5. Keith Davis : Organization Theory (MAC)

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20M305	INDIAN ADMINISTRATIVE SYSTEM (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the Indian administration system.
- Learn the different roles of government authorities.
- Understand the constitutional amendment Act.
- Understand the functions of Integrity and Vigilance in Indian Administration.
- Knowledge about corruption and different policies of government

UNIT I **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 **9**

Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III **9**

Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV **9**

Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V **9**

Corruption – Ombudsman, Lok Pal & Lok Ayuktha

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Know about the Indian administration system.
- Knowledge about the different roles of government authorities.
- Know the constitutional amendment Act.
- Understand the functions of Integrity and Vigilance in Indian Administration.
- Get Awareness about corruption and different policies of government

REFERENCES:

1. S.R. Maheswari : Indian Administration
2. Khera. S.S : Administration in India
3. Ramesh K. Arora : Indian Public Administration
4. T.N. Chaturvedi : State administration in India
5. Basu, D.D : Introduction to the Constitution of India

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BOS/ECE

20M306	PUBLIC POLICY ADMINISTRATION (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the public policy in administration system.
- Learn the different approaches of policies.
- Understand the stages involved in policy making process.
- Understand the role of Interest groups and political parties.
- Knowledge about public policies of government

UNIT-I **9**

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration.

UNIT-II **9**

Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System's Approach – Dror's Optimal Model

UNIT-III **9**

Major stages involved in Policy making Process – Policy Formulation – Policy Implementation – Policy Evaluation.

UNIT-IV **9**

Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT-V **9**

Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Get aware about the public policy in administration system.
- Implement the different approaches of policies.
- Get knowledge about the stages involved in policy making process.
- Know the role of Interest groups and political parties.
- Get a knowledge about public policies of government

REFERENCES:

1. Rajesh Chakrabarti & Kaushik Sanyal : Public Policy in India, Oxford University Press, 2016.
2. Kuldeep Mathur : Public Policy and Politics in India, Oxford University Press, 2016.
3. Bidyutv Chakrabarty: Public Policy: Concept, Theory and Practice, 2015.
4. Pradeep Saxena : Public Policy Administration and Development
5. Sapru R.K. : Public Policy: Formulation, Implementation and Evaluation, Sterling Publishers,2016.

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BOS/ECE

20M401	STATISTICS FOR MANAGEMENT	L T P C
	(COMMON TO ALL BRANCHES)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the applications of distribution techniques
- Understand the sampling and estimation concepts
- Analyze Hypothesis Testing and their applications
- Know about different tests for analytics
- Provide the students to apply the correlation and regressions for estimating business

UNIT I INTRODUCTION **9**

Basic definitions and rules for probability, Bayer'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

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BoS (AD)

OUTCOMES:

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

- Facilitate objective solutions in distribution techniques
- Analyze and solve sampling and estimation concepts
- Apply statistical techniques for Hypothesis Testing
- Develop skill-set that is in demand in both the research and business environments
- Enable the students to apply the correlation and regressions to estimate the business

TEXT BOOKS:

1. Richard I Levin, David S Rubin, Masood H Siddiqui, Sanjay Rastogi, "Statistics for Management", Pearson Education, 8th Edition, 2017.
2. Ken Black, "Applied Business Statistics", 7th Edition, Wiley India Edition, 2012.

REFERENCES:

1. Prem S Mann, "Introductory Statistics", Wiley Publications, 9th Edition, 2015.
2. Srivastava T N and Shailaja Rego, "Statistics for Management", Tata McGraw Hill, 3rd Edition 2017.
3. David R Anderson, Dennis J Sweeney, Thomas A Williams, Jeffrey D Camm, James J Cochran, "Statistics for business and economics", 13th Edition, Thomson (South – Western) Asia, Singapore, 2016.
4. Vohra N D, "Business Statistics", Tata McGraw Hill, 2017.

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BoS (AD)

20M402	DATA MINING FOR BUSINESS INTELLIGENCE (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Know how to derive meaning form huge volume of data and information
- Understand how knowledge discovering process is used in business decision making
- Learn about predictive Analytics and their applications
- Apply the techniques of clustering and classification in Business Intelligence
- Able to use various algorithms for Machine Learning and Artificial Intelligence.

UNIT I INTRODUCTION 9

Data mining, Text mining, Web mining, Data ware house.

UNIT II DATA MINING PROCESS 9

Data mining process - KDD, CRISP-DM, SEMMA Prediction performance measures.

UNIT III PREDICTION TECHNIQUES 9

Data visualization, Time series - ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES 9

Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI 9

Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm Optimization

TOTAL: 45 PERIODS

OUTCOMES:

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

- Learn to apply various data mining techniques into various areas of different domains
- Be able to interact competently on the topic of data mining for business intelligence
- Apply various prediction techniques
- Learn about clustering and classification technique
- Develop and implement machine learning algorithms

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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 Publishers2006
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

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BoS (AD)

20M403	HUMAN RESOURCE ANALYTICS	L T P C
	(COMMON TO ALL BRANCHES)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy
- Know the different types of HR metrics and understand their respective impact and application
- Understand the impact and use of HR Analytics in Training and Development
- Understand common workforce issues and analyze for engaging the employees
- Learn about Workforce Diversity and Development Metrics

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 ANLYTICS 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

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OUTCOMES:

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

- Learners will be conversant about HR metrics and ready to apply at work settings
- Learners will be able to resolve HR issues using people analytics
- Able to analyze using HR Analytics for Training and Development
- Develop Employee Engagement Metrics and Career Progression Metrics on their own.
- Use Workforce Diversity and Development Metrics for developing Business.

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", 3rd 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 Metrices", HBR, 2001.

CHAIRMAN
BoS (AD)

20M404	MARKETING AND SOCIAL MEDIA WEB ANALYTICS (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the applications Marketing Analytics for budget and performance.
- Showcase the opportunities that exist today to leverage the power of the web and social media
- Understand the Social Media Policies and problems posed by emerging social media
- Analyze the web data using web analytics strategies.
- Familiarize with various web analytics tools such as Google Analytics, Adobe Analytics, or other similar platforms

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

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BoS (AD)

OUTCOMES:

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

- Understand the fundamentals and importance of marketing analytics
- Gain familiarity with popular web analytics tools and technologies used in marketing and social media, such as Google Analytics, Facebook Insights, or Twitter Analytics
- Learn about Social media policies and measurements
- Assess the effectiveness of marketing and social media campaigns by tracking and analyzing key metrics and KPIs, and make data-driven decisions
- Adapt to emerging technologies, trends, and changes in the field of web analytics and social media marketing, and stay updated with industry advancements.

TEXT BOOKS:

1. Takeshi Moriguchi, "Web Analytics Consultant Official Textbook", 7th 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.

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BoS (AD)

20M405	OPERATION AND SUPPLY CHAIN ANALYTICS (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the role of analytics in operations and supply chain management
- Learn fundamental concepts and techniques in Warehousing Decisions
- Know the Inventory management methods and models
- Use the network models and algorithms for transportation
- Learn Multiple Criteria Decision Making (MCDM) models is to equip students with the knowledge and skills to effectively analyze complex decision problems involving multiple criteria or objectives

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

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BoS (AD)

OUTCOMES:

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

- Enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.
- Ability to learn techniques to optimize warehouse processes and improve overall operational efficiency.
- Familiar with inventory management principles within the context of warehousing
- Gain a comprehensive understanding of the fundamental principles and concepts of transportation networks, including the role of transportation in supply chain management
- Apply the various MCDM methods and techniques

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.

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BoS (AD)

20M406	FINANCIAL ANALYTICS	L T P C
	(COMMON TO ALL BRANCHES)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the principles of corporate finance and analyze financial statements
- Apply finance market analysis in real-world scenarios
- Ability to apply theoretical knowledge to practical portfolio management and investment decision-making
- Learn Technical analysis for predicting financial data using charts and fundamental
- Able to assess the risk of default and assign credit ratings or risk scores

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

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BoS (AD)

OUTCOMES:

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

- Gain a solid understanding of the fundamental principles and concepts of corporate finance, including time value of money, risk and return, capital budgeting, cost of capital, and capital structure
- Apply finance market analysis techniques to real-world scenarios through case studies, simulations, or projects
- Use portfolio analysis in real-world scenarios
- The learners should be able to perform technical analysis for decision making using excel, Python and R
- Understand the techniques can be used to reduce credit risk exposure

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.

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BoS (AD)

20M501 SUSTAINABLE INFRASTRUCTURE DEVELOPMENT

(Common to all Branches) **L T P C**

3 0 0 3

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

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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 - 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

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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.

REFERENCE BOOKS:

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. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press, ISBN: 1852930039.
7. Munier N, "Introduction to Sustainability", Springer2005
8. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
9. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009.
10. 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.
11. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
12. Greger Lundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.

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20M502 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT

(Common to all Branches)

L	T	P	C
3	0	0	3

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.

REFERENCE BOOKS:

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

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20M503 **SUSTAINABLE BIO MATERIALS**

(Common to all Branches)

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 BIOCOMPOSITES **9**

General properties- Bio ceramics -Silicate glass - Alumina (Al_2O_3) -Zirconia (ZrO_2)-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 NANOBIOMATERIALS 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.

REFERENCE BOOKS:

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.

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20M504 **MATERIALS FOR ENERGY SUSTAINABILITY**

(Common to all Branches)

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Understand the challenges and demands of sustainable energy sources.
- Gain fundamental knowledge about electrochemical devices and materials.
- Classify the various types of fuel cells.
- Illustrate the novel materials and their usage in photovoltaic application.
- Identify the basic principles of various types of supercapacitors and types of nano composites used in SC electrodes.

UNIT I SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O_2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, $LiCoO_2$, $LiFePO_4$, $LiMn_2O_4$) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based).

UNIT III FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell –

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Fuel utilization – electrolyte membrane (proton conducting and anion conducting)– Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flowfield plate, current conductors, bipolar plates and monopolar plates).

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 – $Cu(InGa)Se_2$ solar cells – Cadium 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.

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- 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.

REFERENCE BOOKS:

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.

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20M505 **GREEN TECHNOLOGY**

(Common to all Branches)

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

REFERENCE BOOKS:

1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

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20M506 ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS

(Common to all Branches)

L	T	P	C
3	0	0	3

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-Hill Companies, Inc.
2.Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / Pradyot Patnaik, 1997 by CRC Press, Inc

REFERENCE BOOKS:

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.

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20M507 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

(Common to all Branches)

L	T	P	C
3	0	0	3

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, Incomeand 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.

REFERENCE BOOKS:

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

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20M508 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT

(Common to all Branches)

L	T	P	C
3	0	0	3

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,

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illumination systems and cooling towers

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.

REFERENCE BOOKS:

1. Energy Manager Training Manual (4Volumes) available at http://www.emea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutorybody under Ministry of Power, Government of India.2004
2. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4thEdition,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 IndiaPublishing 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.

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