Kongunadu College of Engineering and Technology (Autonomous)

Affiliated to Anna University, Chennai

B.Tech. – Artificial Intelligence and Data Science

Regulations: KNCET-UGR2020

Choice Based Credit System

I to VIII Semesters Curricula & Syllabi

(Applicable for the students Admitted from 2021-22 Onwards)

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
Practical							
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.	20EC304	Digital Principles and System Design	ESC	3	0	0	3
4.	20BS201	Environmental Science	HSMC	3	0	0	3
5.	20BE203	Basic Electrical, Electronics and Measurement Engineering	ESC	3	0	0	3
6.	20CS201	Python Programming	PCC	3	0	0	3
7.	20TA201**	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1
Practical							
8.	20GE201L	Engineering Practices Laboratory	ESC	0	0	2	1
9.	20CS202L	Python Programming Laboratory	PCC	0	0	2	1
10.	20EEC201L	Soft Skills	EEC	0	0	2	1
			Total	**19**	**1**	**6**	**23**

* - 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.	20MA301	Discrete Mathematics	BSC	3	1	0	4
2.	20AD301	Data Structures and Algorithms Analysis	PCC	3	0	0	3
3.	20AD302	Fundamentals of Data Science	PCC	3	0	0	3
4.	20CS402	Database Management Systems	PCC	3	0	0	3
5.	20IT401	Operating Systems	PCC	3	0	0	3
6.	20IT402	Software Engineering	PCC	3	0	0	3
Practical							
7.	20AD303L	Data Structures and Algorithms Analysis Laboratory	PCC	0	0	2	1
8.	20AD304L	Fundamentals of Data Science Laboratory	PCC	0	0	2	1
9.	20CS404L	Database Management Systems Laboratory	PCC	0	0	2	1
10.	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.	20AD401	Artificial Intelligence	PCC	3	0	0	3
3.	20CS401	Computer Networks	PCC	3	0	0	3
4.	20CS601	Big Data Analytics	PCC	3	0	0	3
5.	20IT301	Java Programming	PCC	3	0	2	4
6.	20MC003	Constitution of India	MC	2	0	0	0
Practical							
7.	20AD402L	Artificial Intelligence Laboratory	PCC	0	0	2	1
8.	20CS603L	Data Analytics Laboratory	PCC	0	0	2	1
9.	20EEC401L	Life Skills and Personality Development	EEC	0	0	2	1
			Total	**17**	**1**	**8**	**20**

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Semester – V							
S.No	Course Code	Course Title	Course Category	No. of Hours / Week			Credit
				L	T	P	
Theory							
1.	20AD501	Business Analytics	PCC	3	0	0	3
2.	20AD502	R Programming	PCC	3	0	2	4
3.	20AD503	Machine Learning Techniques	PCC	3	0	0	3
4.	20AD504	Text Analytics	PCC	3	0	0	3
5.	20MC002	Universal Human Values 2: Understanding Harmony	MC	2	1	0	3
6.		Professional Elective-I	PEC	3	0	0	3
Practical							
7.	20AD505L	Machine Learning Laboratory	PCC	0	0	2	1
8.	20AD506L	Mini Project-I	EEC	0	0	2	1
9.	20EEC501L	Professional Skills Development	EEC	0	0	2	1
			Total	**17**	**1**	**8**	**22**

Semester – VI							
S.No	Course Code	Course Title	Course Category	No. of Hours / Week			Credit
				L	T	P	
Theory							
1.	20AD601	Basics of Computer Vision	PCC	3	0	0	3
2.	20AD602	Web Development Fundamentals	PCC	3	0	0	3
3.	20AD603	Cloud Computing Fundamentals and Applications	PCC	3	0	2	4
4.		Professional Elective-II	PEC	3	0	0	3
5.		Open Elective-I	OEC	3	0	0	3
Practical							
6.	20AD604L	Web Technology Laboratory	PCC	0	0	2	1
7.	20AD605L	Mini Project-II	EEC	0	0	2	1
8.	20EEC601L	Employability Skills	EEC	0	0	2	1
			Total	**15**	**0**	**8**	**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.	20AD701	AI in Robotics	PCC	3	0	0	3
2.	20AD702	Deep Learning Techniques	PCC	3	0	0	3
3.	20AD703	Data and Information Security	PCC	3	0	0	3
4.		Professional Elective-III	PEC	3	0	0	3
5.		Professional Elective-IV	PEC	3	0	0	3
6.		Open Elective-II	OEC	3	0	0	3
Practical							
7.	20AD704L	Deep Learning Laboratory	PCC	0	0	2	1
8.	20AD705L	Data and Information Security Laboratory	PCC	0	0	2	1
			Total	**18**	**0**	**4**	**20**

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
Practical							
3.	20AD801L	Project Work	EEC	0	0	20	10
			Total	**6**	**0**	**20**	**16**

Total no. of credits: 166

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI	Vertical VII
Intelligent Systems and Analytics	**Full Stack Development for IT**	**Cloud Computing and Data Center Technology**	**Cyber Security and Data Privacy**	**Creative Media**	**Emerging Technologies**	**Computational Intelligence**
Knowledge Engineering	Mobile Application Development	Virtualization	Cyber Security and Privacy	Virtual Reality	Robotics Process Automation	Optimization Techniques
Recommender Systems	Cloud Services Management	Data Warehousing	Digital Forensics	Computer Graphics and Multimedia	Neural Networks and Deep Learning	Reinforcement Learning
Fundamentals of Natural Language Processing	User Interface Design	Storage Technologies	Modern Cryptography	Video Creation and Editing	Quantum Computing	Game Theory
Health Care Analytics	Software Testing	Software Defined Networks	Ethical Hacking	Digital Marketing	3D Printing and Design	Ethics and AI
Image and Video Analytics	Web Application Security	Security and Privacy in Cloud	Secure Software Systems	Multimedia Data Compression and Storage	Introduction to Internet of Things	Agile Methodologies
Engineering Predictive Analytics	DevOps	Distributed Systems	Blockchain	Game Development	Principles of Electronic Commerce	Soft Computing
Cognitive Science and Analytics	Human Computer Interaction	Information Retrieval Techniques	Cryptography Principles and Network Security	Visual Effects	Social Network Analysis	Genetic Algorithms

Registration of Professional Elective Courses from Verticals:

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

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PROFESSIONAL ELECTIVE COURSES (PEC): VERTICALS

Vertical I: Intelligent Systems and Analytics

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20AD101PE	Knowledge Engineering	PEC	2	0	2	3
2	20AD102PE	Recommender Systems	PEC	3	0	0	3
3	20AD103PE	Fundamentals of Natural Language Processing	PEC	3	0	0	3
4	20AD104PE	Health Care Analytics	PEC	3	0	0	3
5	20AD105PE	Image and Video Analytics	PEC	2	0	2	3
6	20AD106PE	Engineering Predictive Analytics	PEC	3	0	0	3
7	20AD107PE	Cognitive Science and Analytics	PEC	3	0	0	3

Vertical II: Full Stack Development

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20IT601PE	Mobile Application Development	PEC	3	0	0	3
2	20AD201PE	Cloud Services Management	PEC	2	0	2	3
3	20IT706PE	User Interface Design	PEC	3	0	0	3
4	20CS701PE	Software Testing	PEC	3	0	0	3
5	20AD202PE	Web Application Security	PEC	2	0	2	3
6	20AD203PE	DevOps	PEC	2	0	2	3
7	20IT707PE	Human Computer Interaction	PEC	3	0	0	3

Vertical III: Cloud Computing and Data Center Technology

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20AD301PE	Virtualization	PEC	2	0	2	3
2	20AD302PE	Data Warehousing	PEC	3	0	0	3
3	20AD303PE	Storage Technologies	PEC	3	0	0	3
4	20IT807PE	Software Defined Networks	PEC	3	0	0	3
5	20AD304PE	Security and Privacy in Cloud	PEC	3	0	0	3
6	20CS503PE	Distributed Systems	PEC	3	0	0	3
7	20CS705PE	Information Retrieval Techniques	PEC	3	0	0	3

Vertical IV: Cyber Security and Data Privacy

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20AD401PE	Cyber Security and Privacy	PEC	3	0	0	3
2	20AD402PE	Digital Forensics	PEC	3	0	0	3
3	20AD403PE	Modern Cryptography	PEC	2	0	2	3
4	20IT804PE	Ethical Hacking	PEC	`1	0	0	3
5	20AD404PE	Secure Software Systems	PEC	2	0	2	3
6	20AD405PE	Blockchain	PEC	3	0	0	3
7	20AD406PE	Cryptography Principles and Network Security	PEC	3	0	0	3

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Vertical V: Creative Media

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20AD501PE	Virtual Reality	PEC	3	0	0	3
2	20IT701PE	Computer Graphics and Multimedia	PEC	3	0	0	3
3	20CS607PE	Video Creation and Editing	PEC	2	0	2	3
4	20AD502PE	Digital Marketing	PEC	3	0	0	3
5	20AD503PE	Multimedia Data Compression and Storage	PEC	3	0	0	3
6	20CS608PE	Game Development	PEC	2	0	2	3
7	20AD504PE	Visual Effects	PEC	3	0	0	3

Vertical VI: Emerging Technologies

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20AD601PE	Robotics Process Automation	PEC	3	0	0	3
2	20CS807PE	Neural Networks and Deep Learning	PEC	2	0	2	3
3	20AD602PE	Quantum Computing	PEC	2	0	2	3
4	20AD603PE	3D Printing and Design	PEC	3	0	0	3
5	20EC503OE	Introduction to Internet of Things	PEC	3	0	0	3
6	20IT802PE	Principles of Electronic Commerce	PEC	3	0	0	3
7	20IT702PE	Social Network Analysis	PEC	3	0	0	3

Vertical VII: Computational Intelligence

S.No.	Course Code	Name of the Course	Course Category	No. of Hours / Week			Credit
				L	T	P	
1	20CS509PE	Optimization Techniques	PEC	2	0	2	3
2	20AD701PE	Reinforcement Learning	PEC	3	0	0	3
3	20AD702PE	Game Theory	PEC	3	0	0	3
4	20AD703PE	Ethics and AI	PEC	2	0	2	3
5	20AD704PE	Agile Methodologies	PEC	3	0	0	3
6	20CS704PE	Soft Computing	PEC	3	0	0	3
7	20AD705PE	Genetic Algorithms	PEC	3	0	0	3

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Open Elective Courses (OEC)

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

Semester-VI

Open Elective Course-I

S.No.	Course Code	Name of the Course	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.	20EC501OE	Sensors and Transducers	OEC	3	0	0	3
7.	20EE501OE	Non-Conventional Energy Resources	OEC	3	0	0	3
8.	20EE502OE	Industrial Automation	OEC	3	0	0	3
9.	20EE503OE	Energy Management and Auditing	OEC	3	0	0	3
10.	20ME601OE	Production Technology	OEC	3	0	0	3
11.	20ME602OE	Basics of Automotive Components	OEC	3	0	0	3

Semester-VII

Open Elective Course-II

S.No.	Course Code	Name of the Course	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.	20EC701OE	Consumer Electronics	OEC	3	0	0	3
6.	20EC702OE	RFID and Flexible Sensors	OEC	3	0	0	3
7.	20EE701OE	Energy Storage Systems	OEC	3	0	0	3
8.	20EE702OE	Electrical Safety Engineering	OEC	3	0	0	3
9.	20ME701OE	Basics of Hydraulic and Pneumatic Systems	OEC	3	0	0	3
10.	20ME702OE	Alternative Energy Fuels	OEC	3	0	0	3

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SUMMARY

S.No.	Course Category	Credits as per Semester								Total Credit	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	4	7	-	-	3	-	-	-	14	8.43
2.	BSC	11	7	4	4	-	-	-	-	26	15.66
3.	ESC	7	4	-	-	-	-	-	-	11	6.63
4.	EEC	1	1	1	1	2	2	-	10	18	10.84
5.	PCC	-	4	18	15	14	11	11	-	73	43.98
6.	PEC	-	-	-	-	3	3	6	6	18	10.84
7.	OEC	-	-	-	-	-	3	3	-	6	3.62
Total		23	23	23	20	22	19	20	16	166	100

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

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

Vertical I	**Vertical II**	**Vertical III**	**Vertical IV**	**Vertical V**
Domain Name				
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 I: 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 II: 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 III: 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 IV: 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 V: 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

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CSE

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 student 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 Book:

1. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford University Press, 2nd edition, 2015.

References:

1. P Kiranmai and Rajeevan Geeta. "Basic Communication Skills", Foundation Books, revised edition, 2013.
2. Redston, Chris & Gillies Cunningham. "Face2Face (Pre-Intermediate Student's Book & Workbook",Cambridge University Press, New Delhi. 2nd edition,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, 2nd edition,2009.
5. Hewings, Martin. "Advanced English Grammar: A self study reference and Practice book for advanced South Asian students" Cambridge University Press, New Delhi, revised edition, 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.

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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

OUTCOME:

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

- Eigenvalues 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", 7th Edition, Cengage Learning, 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 crystals 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 applications.

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.

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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

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", Dhanpat Rai Publications, New Delhi, 2014.
2. Marikani A, "Engineering Physics", PHI learning Pvt. Ltd, New Delhi, 2nd Edition, 2013.
3. Avadhanulu M N, "Engineering Physics", S Chand and Company Ltd, New Delhi, 1st 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 & its Applications – Electrochemical series – Corrosion – Types – Dry & 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 – Theoretical 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 McGraw 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 3 0 0 3

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.

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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

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 developments of surfaces
- Make the students 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, Epicycloids – 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 lengths and true inclinations by rotating line method. Projection of planes inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **7+6**

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **9+6**

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

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

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids : Prisms, pyramids, cylinders, cone – Perspective projection of simple solids:Prisms, pyramids and cylinders by visual ray method.

TOTAL (45+30): 75 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 projections of points, straight lines and plane surfaces
- Understand the projection of solids in various positions
- Construct projections of solids and development of surfaces
- Draw isometric and perspective sections of simple solids

TEXT BOOKS:

1. Natrajan 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
1 0 0 1

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 the types of ions in drinking water
- Analyze the characteristics of acids
- Know the conductivity of a solution

LIST OF 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 by 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 Na2CO3 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 parameters.
- 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 & 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 READING 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.

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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: 45PERIODS

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-Riemannequations 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).

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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

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. RajnishVerma," Higher Engineering Mathematics", S Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2012.
3. Jain RK 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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20EC304	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L T P C
	(COMMON TO CSE, IT AND AD)	3 0 0 3

OBJECTIVE:

The Student should be made to:

- Understand the Digital fundamentals, Boolean algebra and its applications in digital systems
- Familiarize with the design of various combinational digital circuits using logic gates
- Gain the knowledge on analysis and design procedures for Synchronous circuits
- Gain the knowledge on analysis and design procedures for Asynchronous circuits
- Understand the concept of Semiconductor memories

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, radix conversion, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems & Postulates – Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization.

UNIT II COMBINATIONAL LOGIC 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Binary Multiplier, Multiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder – Parity checker & Generator, Introduction to HDL – HDL Models of Combinational circuits.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 9

Latches, Flip flops – SR, JK, T, D – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design of Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters: Ripple Counters, Synchronous Counter, Ring Counters – Shift registers – Universal Shift Register – HDL Models of Sequential Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

Stable and Unstable states – output specifications – cycles and races – state reduction – race free assignments – Hazards, Essential Hazards – Pulse mode sequential circuits – Design of Hazard free circuits.

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UNIT V MEMORY AND PROGRAMMING LOGIC 9

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Simplify digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Analysis and design various synchronous and asynchronous sequential circuits
- Understand the semiconductor memories and related technology
- Demonstrate the electronic circuits involved in the design of logic gates

TEXT BOOK:

1. Morris Mano M, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilo", Pearson Education, 6th Edition, 2018.

REFERENCES:

1. Kharate G K, "Digital Electronics", Oxford University Press, 2010.
2. John F Wakerly, "Digital Design Principles and practices", Pearson education, 5th Edition, 2017.
3. Charles H Roth Jr, Larry L Kinney, "Fundamentals of Logic design", Cengage learning, 6th Edition, 2013.

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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 PvtLtd, New Delhi, 2007.

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20BE203	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING (COMMON TO CSE, IT and AD)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Explain the basic knowledge about laws used in electrical circuits
- Understand the modeling and operation of electrical machines
- Learnthe principles and operation of measuring instruments and transducers
- Introduce the basic concepts of semiconductor devices
- Study the energy saving methods and different ways of illumination

UNIT I FUNDAMENTALS OF ELECTRICITY AND DC CIRCUITS 9

Introduction – Definition, Symbol and unit of quantities –Ohm'sLaw - Network terminology -Kirchhoff'slaw – Resistancein series and voltage division technique – Resistancein parallel and current division technique – Loopanalysis – Nodalanalysis – Star to delta and delta to star transformation.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Principle, construction, EMF Equation, Types – Characteristicsof DC motor.

AC Machines: Construction and working principle of transformer – Construction, working of three phase induction motor – Constructionand types of single phase induction motors.

UNIT III ELECTRICAL MEASUREMENT 9

Classification of instruments – Basicprinciple of indicating instruments – Movingiron instruments – Movingcoil instrument – Energymeter – Wattmeter – Classificationof transducer, Capacitive and inductive transducer-LVDT – StrainGauge – Halleffect – piezoelectrictransducer.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Introduction to semiconductors –PNjunction diode, Zener diode 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 . Displaydevices: LED and LCD.

UNIT V UTILIZATION OF ELECTRICAL POWER 9

Terms used in illumination – Lawsof illumination – Sourcesof light – Arclamps – Gaseousdischarge lamps: Sodium vapour lamp, High pressure mercury vapour lamp, Fluorescent tubes, Compact fluorescent lamps (CFLs) – Domesticrefrigerator – Airconditioner – Basic principles of earthing –Tariffs and its types.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Apply various theorems for the analysis 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 energy saving methods and different ways of illumination

TEXT BOOKS:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical Electronics and Computer ScienceEngineering", 3rd Reprint, TheMcGraw Hill, 2009.
2. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2012.

REFERENCES:

1. TherajaB L, "Fundamentals of Electrical Engineering and Electronics", Chand & Co, 2008.
2. SukhijaM S and Nagsarkar T K, "Basic Electrical and Electronic Engineering", 3rd Edition, Oxford, 2017.
3. Mehta V K, "Principles of Electronics",7th Edition,S.Chand& Company Ltd, 2014.
4. Sivanagaraju S, Balasubba Reddy M, Srilatha D, "Generation and Utilization of Electrical Energy", Pearson Education, 2010.

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20CS201	PYTHON PROGRAMMING (COMMON TO CSE, IT AND AD)	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- Acquire knowledge about the fundamentals of Python language.
- Learn about Control flow and functions in Python language.
- Develop programs using object oriented programming concepts.
- Use Python data structures like lists, tuples, and dictionaries.
- Build application that handles files and exceptions.

UNIT I INTRODUCTION TO PYTHON 9

Programming Languages – Python History – Getting Started with Python – Writing a Simple program – Reading input from console – Identifiers – Variables, Assignment Statements and Expressions – Simultaneous Assignments – Named Constants – Data Types and Operators – Evaluating expressions – Augmented Assignment operators – Type conversion – Common Python Functions – Strings and Characters – Objects and Methods – Formatting Numbers and Strings.

UNIT II CONTROL STATEMENTS AND FUNCTIONS 9

Selections: if –Two way if-else – Nested if and Multi-way if-elif-else Statements – Logical Operators – Conditional Expressions – Operator Precedence and Associativity – Loops: while – for – Nested Loops – break and continue – Function: Definition – Calling and Returning values – Positional and keyword arguments – Passing arguments by reference values – Modularizing Code – Scope of variables – Default Arguments – Function Abstraction and Stepwise Refinement –Recursion.

UNIT III OOP CONCEPTS IN PYTHON 9

Object and classes – Defining classes for objects – UML Class diagram – Immutable Objects vs. Mutable Objects – Hiding data fields – Class abstraction and encapsulation – Object–Oriented Thinking – The str Class – Inheritance and Polymorphism: Super classes and Sub classes – overriding methods – Object class – Polymorphism and Dynamic Binding – The insistence Function – Class Relationships.

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UNIT IV DATA STRUCTURES IN PYTHON 9

List Basics – Copying Lists – Passing List to Functions – Returning a List from function – Searching Lists – Multidimensional Lists – Tuples – Sets – Comparing Sets and Lists – Dictionaries.

UNIT V FILES AND EXCEPTION HANDLING 9

Introduction – Text Input and Output – File Dialogs – Retrieving Data from the Web – Exception Handling– Raising Exceptions – Processing Exception using Exception Objects – Defining Custom Exception Classes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basics of python programming languages.
- Apply the concepts of Control flow and functions to build applications.
- Build solutions using the concepts of object oriented programming.
- Design applications using data structures for real–time problems.
- Develop programs by using files and exception handling for the given scenario.

TEXT BOOKS:

1. Y.Daniel Liang, "Introduction to Programming Using Python", Pearson Education, 2013.

REFERENCES:

1. Timothy A. Budd, "Exploring Python", McGraw Hill Education (India) Private Ltd, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff / O'Reilly Publishers,2016. (http://greenteapress.com/wp/think–python/)
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter–disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Mark Lutz, "Learning python", O'Reilly Publication, 5thEdition, 2013.
5. Guido Van Rossum and Fred L. Drake Jr, "An Introduction to Python", Revised and Updated for Python 3.2, Network Theory Ltd., 2011.

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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 L T P C
(அனைத்து துறைகளுக்கும் பொதுவானது) 1 0 0 1

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)
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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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.

4. **Machine assembly practice:**

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(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: 30PERIODS

COURSE OUTCOMES:

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

- Applying 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
- Analyzing the engineering knowledge through welding, sheet metal forming, bending and basic machining operations
- Understanding the assembly works on study of pump, Air conditioner and demonstration works on Smithy, foundry and fitting operations
- 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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20CS202L	PYTHON PROGRAMMING LABORATORY (COMMON TO CSE, IT AND AD)	L T P C 0 0 2 1

OBJECTIVE:

The Student should be made to:

- To use control statements, functions and strings in Python programs.
- Represent compound data using Python lists, tuples.
- Read and write data from/to files in Python.
- To develop python programs using modules, packages and/or exception handling.
- To implement the object oriented concepts in python programming.

Practical Syllabus:

1. Programs using conditional statements.
2. Programs using operators and built in functions.
3. Programs performing string operations.
4. Programs using functions.
5. Programs to perform operations on list.
6. Programs using dictionary and set.
7. Programs to work with tuples.
8. Program to perform word count in file.
9. Program to copy file.
10. Program to read and write file.
11. Programs using modules and packages.
12. Program using Classes and objects.
13. Program using the concept of superclasses and subclasses.
14. Program using the concept of polymorphism and dynamic over loading.

TOTAL: 30 PERIODS

OUTCOME:

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

- Solve problems using control statements, functions and strings in Python.
- Make use of Python lists, tuples to represent compound data.
- Build Python Programs to read and write data from/to files.
- Develop python programs using modules and packages with exception handling.
- Construct python program using object oriented concepts.

List of Equipment for a Batch of 30 Students:

1. Standalone desktops with Python 3 interpreter for Windows/Linux 30 Nos.

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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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20MA301	DISCRETE MATHEMATICS (Common to CSE, IT and AD)	L T P C 3 1 0 4

OBJECTIVES:

The Student should be made to:

- Understand the Logical and Mathematical maturity and ability to deal with abstraction
- Introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems
- Understand the basic concepts of combinatorics and graph theory
- Familiarize theapplications of algebraic structures
- Understand the concepts and significance oflattices and Boolean algebra which are widely used in computer science and engineering

UNIT I LOGIC AND PROOFS **12**

Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers –bRules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS **12**

Mathematical induction – Strong induction and well ordering – The basics of counting – Thepigeonhole principle – Permutations and combinations – Recurrence relations – Solving linearrecurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III GRAPHS **12**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation ofgraphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES **12**

Algebraic systems – Semi groups and monoids–Groups – Subgroups – Homomorphism's – Normalsubgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA **12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems –Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Have knowledge of the concepts needed to test the logic of a program
- Have an understanding in identifying structures on many levels
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science
- Be aware of the counting principles
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields

TEXT BOOKS:

1. Rosen K H, "Discrete Mathematics and Its Applications", Tata McGrawHill Publication Co. Ltd., New Delhi, 7th Edition (Special Indian Edition), 2011.
2. Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publication Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES:

1. Grimaldi R P, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, New Delhi,4th Edition, 2007.
2. Lipschutz S and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Publication Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy T, "Discrete Mathematics with Applications", Elsevier Publications, 2006.

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20AD301 DATA STRUCTURES AND ALGORITHMS ANALYSIS **L T P C**
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the various algorithm design and analysis techniques
- Learn linear data structures – lists, stacks, and queues
- Learn different sorting and searching algorithms
- Understand tree data structures
- Apply the graph data structures

UNIT I ALGORITHM ANALYSIS, LIST ADT 9

Algorithms: Notation – analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists– applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

UNIT II STACKS AND QUEUES 9

Stack ADT – Applications – Evaluating arithmetic expressions – Conversion of Infix to Postfix, Recursion. Queue ADT – Priority Queue – applications of queues.Implementation of Stack ADT and palindrome checking using C. Implementation of Queue operations using arrays in C.

UNIT III SEARCHING AND SORTING ALGORITHMS 9

Divide and conquer methodology – Searching: Linear Search – Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort.Analysis of searching and sorting techniques.Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT IV TREES 9

Tree ADT – tree traversals – Binary Tree ADT – expression trees – binary search tree ADT – Applications of trees. Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

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UNIT V GRAPHS 9

Definition – Representation of Graph – Breadth-first traversal –Depth-first traversal – Dynamic programming Technique –Warshall's and Floyd's algorithm – Greedy method – Dijkstra's algorithm –applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basic concepts of algorithm analysis and the list ADT
- Apply stack and queue data structure to solve the problems
- Critically analyze the various searching and sorting algorithms
- Implement and apply trees concepts to solve problems
- Understand and apply various graph algorithm techniques to solve the problems

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2020.
2. Brian W Kernighan and Dennis M Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 2018.

REFERENCES:

1. Sridhar S, "Design and Analysis of Algorithms", First Edition, Oxford University Press, 2014.
2. Byron Gottfried, Jitender Chhabra, "Programming with C" (Schaum's Outlines Series), McGraw Hill Higher Ed., 3rd Edition, 2010.
3. Yashvant Kanetkar, "Data Structures through C", BPB Publications, 2nd Edition, 2003.
4. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, "Data Structures and Algorithms", Pearson Education, 2002.

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20AD302 **FUNDAMENTALS OF DATA SCIENCE** **L T P C**

(COMMON TO AD, CSE AND IT) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- To gain knowledge in the basic concepts of Data Science
- Ability to acquire skills in data preparatory and preprocessing steps
- Students can learn the tools and packages in Python for data science
- Evaluate various problems in classification and Regression Model
- Acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION 9

Need for data science - benefits and uses - facets of data - data science process - setting the research goal - retrieving data - cleaning, integrating, and transforming data - exploratory data analysis - build the models - presenting and building applications - Frequency distributions - Outliers - relative frequency distributions - cumulative frequency distributions - frequency distributions for nominal data - interpreting distributions - graphs-averages - mode - median - mean - averages for qualitative and ranked data.

UNIT II DESCRIBING DATA AND CLUSTERING 9

Describing variability- range - variance - standard deviation - degrees of freedom - interquartile range - variability for qualitative and ranked data-Clustering: Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm) - DBSCAN - Relative merits of each method - clustering tendency and quality.

UNIT III DATA HANDLING 9

Basics of aggregations - computations on arrays - comparisons, masks, Boolean logic - fancy indexing - structured arrays - Data manipulation with Pandas - data indexing and selection - operating on data - missing data - hierarchical indexing - combining datasets - aggregation and grouping - pivot tables.

UNIT IV DISTRIBUTIONS AND REGRESSION 9

Normal distributions - z scores - normal curve problems - finding proportions - finding scores - more about z scores - correlation - scatter plots - correlation coefficient for quantitative data - computational formula for correlation coefficient - regression - regression line - least squares regression line - standard error of estimate - interpretation of r2 - multiple regression equations - regression toward the mean.

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UNIT V DATA VISUALIZATION 9

Visualization with matplotlib - line plots - scatter plots - visualizing errors - density and contour plots - histograms, binnings, and density - three dimensional plotting - geographic data - data analysis using statsmodels and seaborn - graph plotting using Plotly - interactive data visualization using Bokeh.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply the skills of data inspecting and cleaning
- Determine the relationship between data dependencies using statistics
- Able to handle data using primary tools used for data science in Python
- Represent the useful information using mathematical skills
- Apply the knowledge for data describing and visualization using tools

TEXT BOOKS

1. Davy Cielen, Arno DB Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (First two chapters for Unit I)
2. Robert SWitte and John SWitte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1-7 for Units II and III)
3. Jake Vanderplas, "Python Data Science Handbook", O'Reilly, 2016. (Parts of chapters 2-4f or Units IV and V)

REFERENCES

1. Allen B Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

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20CS402	DATABASE MANAGEMENT SYSTEMS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study the fundamentals of data models and SQL.
- Represent a database system using ER diagrams.
- Understand the fundamental concepts of transaction processing– concurrency control techniques and recovery procedures.
- Have an introductory knowledge about the Storage and Query processing Techniques.
- Learn the applications in database management systems.

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of data – Database Languages – Database Architecture – Introduction to Relational Model –Structure of Relational Databases – Database Schemas – Keys – Schema Diagrams – Relational Query Languages – Relational Operations – Instruction to SQL – Accessing SQL from a programming language.

UNIT II DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Reduction to Relational Schema – Extended E-R Features– Atomic Domains and First Normal Form – Decomposition using Functional Dependencies – Functional Dependency Theory – Algorithm for Decomposition – Decomposition using Multi-Valued Dependencies – More Normal Forms.

UNIT III DATA STORAGE AND QUERY PROCESSING 9

Overview of Physical Storage Media – Magnetic Disks and Flash Storage – RAID – Tertiary Storage – File Organization – Organization of Records in Files – Indexing and Hashing: Basic Concepts – Ordered Indices – B+ tree Index Files – B+ tree Extensions – Static Hashing – Dynamic Hashing – Query Processing Overview – Selection Operation – Sorting – Join Operation.

UNIT IV TRANSACTION MANAGEMENT 9

Transaction Concepts –A Simple Transaction Model –State diagram of Transaction – Schedules –Serializability– Concurrency Control– Locking Protocols – Two Phase Locking Protocol – Deadlock Handling –Time Stamp Based Protocols – Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

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UNIT V DATABASE APPLICATIONS 9

Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transaction, Commit Protocols – Information Retrieval: Overview, Relevance Ranking Using Terms, Relevance Using Hyperlinks, Beyond Ranking of Pages– Object-based Databases: Overview, Complex Data types, Implementing Object-Relational features, Persistent Programming Languages – XML Databases: Structure of XML data, XML Document Schema, XPath, XQuery.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify the basic elements of a relational database management system and the data models for relevant problems.
- Analyze various functional dependencies and apply normalization for designing a robust data base in the development of application software.
- Implement transactions, concurrency control, recovery and Query optimization techniques.
- Compare various indexing and hashing techniques.
- Implement the database applications in various scenarios.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, 2020.

REFERENCES:

1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 6th Edition, Pearson, 2011.
2. Date C J, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
3. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, McGraw-Hill Publications, 2015.
4. Gupta G K, "Database Management Systems", Tata McGraw Hill, 2011.

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20IT401	OPERATING SYSTEMS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Acquire the basic knowledge and functions of operating systems
- Understand the concept of process scheduling algorithms
- Learn the mechanism of storage management
- Understand the various memory management techniques
- Be familiar with the concept of file system

UNIT I INTRODUCTION AND OPERATING SYSTEM STRUCTURES 9

Introduction – Mainframe Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems – Hardware Protection – System Components – Operating System Services – System Calls – System Programs – System Structure – Virtual Machines – System Design and Implementation.

UNIT II PROCESS MANAGEMENT 9

Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter–process Communication– Threads – Overview – Threading issues – CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple–Processor Scheduling – Real Time Scheduling – Case study – Linux Scheduling.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS 9

Critical–Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors. System Model – Deadlock Characterization – Methods for handling Deadlocks –Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks.

UNIT IV STORAGE MANAGEMENT AND FILE SYSTEM INTERFACE 9

Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging – Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing – File Concept – Access Methods – Directory Structure – File System Mounting – Protection. Case study – Linux memory management

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UNIT V FILE SYSTEM IMPLEMENTATION AND MASS STORAGE STRUCTURE 9

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management – Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management – Case study – Linux file system.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the concepts and structure of operating systems
- Evaluate the various process scheduling algorithms
- Design algorithms for achieving process synchronization
- Evaluate the various memory management techniques
- Analyze the effectiveness of a file system

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley and Sons Inc., 10th Edition , 2019.

REFERENCES:

1. Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", Pearson Education Pvt. Ltd., 4th Edition, 2016.
2. William Stallings, "Operating System Internals and Design Principles", Pearson Education Pvt.Ltd., 9th Edition, 2018.
3. Harvey M Deitel, Deitel P J and Choffnes D R, "Operating Systems", Pearson Education Pvt. Ltd., 3rd Edition,2004.
4. Gary Nutt, "Operating Systems", Pearson Education, 3rd Edition, 2004.
5. Dhananjay M DhamDhere, "Operating Systems A Concept – Based Approach", McGraw Hill Education India Private Limited, 3rd Edition, 2003.

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20IT402	SOFTWARE ENGINEERING	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made to:

- Gain knowledge about the software process and agile development
- Understand fundamental concepts of requirements engineering and Analysis Modeling
- Understand the various software design methodologies
- Learn about the fundamentals of software testing
- Acquire knowledge aboutsoftware project management

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Nature of Software – Software Engineering Definition –Software Process–Software Engineering Practice –Perspective and Specialized Process Models –Introduction to Agility–Agile process–Extreme programming.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Requirements engineering – Eliciting requirements, Developing use cases – Building the analysis model – Negotiating requirements – Requirements monitoring – Validating requirements – Requirements modeling: Requirements analysis – Scenario based modeling – UML models – Class based methods.

UNIT III SOFTWARE DESIGN 9

Design process – Design concepts – Design models – Architectural design: Software architecture, Architectural styles – Architectural design – Component level design: Views of components, Designing class-based components, Conducting component level design – Designing traditional components – User interface design: User interface analysis and design, Interface analysis, Interface design steps.

UNIT IV SOFTWARE TESTING FUNDAMENTALS 9

Software testing strategies: Strategic approach – Issues – Test strategies for conventional and Object Oriented software –Validation testing and system testing – Debugging –Software Testing Fundamentals –White box testing – Basis path testing – Control structure testing – Black box testing.

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UNIT V SOFTWARE PROJECT MANAGEMENT 9

Software Configuration Management – The SCM repository – The SCM process– Project management concepts – Process and project metrics: Software measurement – Metrics for software quality – Estimation for software projects: Decomposition techniques and empirical estimation models – Project scheduling.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Compare various software development models
- Identify the tasks in requirement engineering
- Summarize the different methods for the design of a software system
- Illustrate various software testing methods
- Interpret software project management and quality metrics

TEXT BOOKS:

1. Roger S Pressman, "Software Engineering – A Practitioner's Approach", McGraw Hill Publication, 8th Edition, 2015.

REFERENCES:

1. Ian Sommerville, "Software Engineering", Pearson Education Asia, 10th Edition, 2016.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, 3rd Edition, 2009.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
4. Stephen R Schach, "Software Engineering", Tata McGraw Hill Publishing Company Limited, 2007.

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20AD303L **DATA STRUCTURES AND ALGORITHMS ANALYSIS LABORATORY**

L T P C
0 0 2 1

OBJECTIVES:

The Student should be made to:

- Implement linear and nonlinear data structures
- Understand the different operations of search trees
- Implement graph traversal algorithms
- Get familiarized about sorting algorithms
- Apply real time problems using searching algorithms

LIST OF EXPERIMENTS

1. Array implementation of Stack and Queue ADTs.
2. Array implementation of List ADT.
3. Linked list implementation of List, Stack and Queue ADTs.
4. Applications of List, Stack and Queue ADTs.
5. Implementation of Binary Trees and operations of Binary Trees.
6. Implementation of Binary Search Trees.
7. Implementation of AVL Trees.
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms and Applications of Graphs.
10. Implementation of searching and sorting algorithms.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Write functions to implement linear and non-linear data structures operations
- Suggest appropriate linear / nonlinear data structure operations for solving a given problem
- Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting
- Apply appropriate hash function that result in a collision free scenario for data storage and retrieval
- Apply sorting and searching algorithm for a given problem

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- Standalone desktops with C compiler 30 Nos.

(or)

- Server with C compiler supporting 30 terminals or more.

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20AD304L **FUNDAMENTALS OF DATA SCIENCE LABORATORY**

L T P C
0 0 2 1

OBJECTIVES:

The Student should be made to:

- Understand the Python Programming packages Python, NumPy, SciPy, Matplotlib, Pandas,Statmodels, Seaborn, Plotly, BokehLanguage
- Prepare data for data analysis through understanding its distribution
- Exposure on data processing using NUMPY and PANDAS
- Acquire knowledge in plotting using visualization tools
- Understand and implement classification and Regression Model

LIST OF EXPERIMENTS:

1. Working with NumPy arrays.
2. Working with Pandas data frames.
3. Basic plots using Matplotlib.
4. Frequency distributions.
5. Averages.
6. Variability.
7. Normal curves.
8. Correlation and scatter plots.
9. Correlation coefficient.
10. Regression.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Develop relevant programming abilities
- Demonstrate knowledge of statistical data analysis techniques
- Exhibit proficiency to build and assess data-based models
- Demonstrate skill in Data management & processing tasks using Python
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- Software Tools:
  - Python, NumPy, SciPy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
- Hardware Tools:

  Standalone desktops 30 Nos.

  (or)

  Server supporting 30 terminals or more.

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20CS404L	DATABASE MANAGEMENT SYSTEMS LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

The Student should be made to:

- Learn how to populate and query a database using DML/DDL commands and Joins.
- Get familiar with the use of tables, views and cursors.
- Learn the concept ofprocedures, functions and triggers.
- Outline an ER model for any given problem.
- Understand ER model and implement a typical database applications with front end.

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying –Simple queries, Nested queries, Sub queries and Joins.
3. Views, Sequences, Synonyms.
4. Database Programming: Implicit and Explicit Cursors.
5. Procedures and Functions.
6. Triggers.
7. Database Design using ER modeling, and implementation for any application.
8. Database Connectivity with Front End Tools.
9. Case Study using real life database applications.

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Use typical data definition and manipulation commands and write queries to retrieve data from the database.
- Critically analyze the use of Tables, Views, and Cursors.
- Implement the Procedures, Functions and triggers for the data in the database
- Design ER model for a defined problem
- Build a GUI application by incorporating the database connectivity using any programming language as front end.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- HARDWARE:

  Standalone desktops 30 Nos.

  (or)

  Server supporting 30 terminals or more.

- SOFTWARE:

  Front end: VB/VC ++ / JAVA or Equivalent

  Back end: Oracle / SQL / MySQL / PostGress / DB2 or Equivalent.

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20EEC301L	SOFTSKILLS 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 & Self Introspection.

UNIT – V CREATIVITY & GOAL SETTING 6

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

TOTAL: 30 PERIODS

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OUTCOMES:

On the 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 & Schuster, 1998.
3. Jeff Butterfield, Soft Skills for Everyone, Cengage Learning, 2011.

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20MA404	PROBABILITY AND STATISTICS (COMMON TO BME, IT & AD)	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 – 2^2factorial 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:

Upon successful completion of the course, 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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20AD401	ARTIFICIAL INTELLIGENCE	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the various characteristics of intelligent agents.
- Learn the different search strategies in AI.
- Learn to represent knowledge in solving AI problems.
- Understand the different ways of designing software agents.
- Know about the various applications of AI.

UNIT I INTRODUCTION 9

Introduction –Foundation and history of AI. AI Problems and techniques –AI programming languages –Introduction to LISP and PROLOG – Problem spaces and searches –Blind search strategies; Breadth first –Depth first –Heuristic search techniques, Hill climbing –Best first – A* algorithm AO* algorithm –game trees Minimax algorithm –Game playing –Alpha beta pruning.

UNIT II KNOWLEDGE REPRESENTATION 9

Knowledge representation issues –Predicate logic –Logic programming –Semantic nets – Frames and inheritance–Constraint propagation –Representing Knowledge using rules –Rules based deduction system.

UNIT III REASONING UNDER UNCERTAINITY 9

Introduction to uncertain knowledge review of probability –Baye's Probabilistic inferences and Dempster Shafer theory –Heuristic methods –Symbolic reasoning under uncertainty– Statistical reasoning –Fuzzy reasoning –Temporal reasoning–Non monotonic reasoning.

UNIT IV PLANNING AND LEARNING 9

Planning –Introduction, Planning in situational calculus –Representation for planning –Partial order planning algorithm –Learning from examples– Discovery as learning –Learning by analogy –Explanation based learning –Introduction to Neural nets –Genetic Algorithms.

UNIT V APPLICATIONS 9

Principles of Natural Language Processing–Rule Based Systems Architecture – Expert systems –Knowledge Acquisition concepts –AI application to robotics –Machine Translation – Speech Recognition.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Use appropriate search algorithms for any AI problem.
- Represent a problem using first order and predicate logic.
- Provide the apt agent strategy to solve a given problem.
- Design software agents to solve a problem.
- Design applications for NLP that use Artificial Intelligence.

TEXT BOOKS:

1. Stuart J. Russell and Peter Norvig."Artificial IntelligenceA Modern Approach", Pearson Education, 3rd Edition, 2010.
2. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Books 3rd Edition, 2000.

REFERENCES:

1. George F Luger, "Artificial Intelligence", Pearson Education, 6th Edition, 2009.
2. Engene Charniak and Drew Mc Dermott, "Introduction to Artificial Intelligence", Addison Wesley, 2013.
3. Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 2002.

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20CS401 **COMPUTER NETWORKS** **L T P C**

(Common to AD, BME, CSE, ECE, EEE and IT) **3 0 0 3**

OBJECTIVES:

The Student should be made to:

- Understand the protocol layering and physical level communication.
- Be familiar with the Data Link layer.
- Gain the knowledge on network protocols, Architectures and applications.
- Examine the functionalities on TCP and UDP.
- Interpret the knowledge on application layer.

UNIT I INTRODUCTION **9**

Data Communications – Data Flow – Networks – Networks types - The Internet – Standards – Network Models– TCP/IP Protocol Suite - The OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II DATA LINK LAYER & MEDIA ACCESS **9**

Introduction – Link-Layer Addressing – Block Coding - Cyclic Coding - Checksum - DLC Services –Data-Link Layer Protocols – HDLC – Media Access Control - Wired LANs: Ethernet – Wireless LANs: IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER **9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV TRANSPORT LAYER **9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V APPLICATION LAYER **9**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the Layered Architecture of Computer Networks.
- Conceptualize the protocols of Data Link Layer and can build Local area networks.
- Apply Subnet and Supernet concepts in the construction of computer network.
- Summarize the protocols used in Transport Layer, QoS and Congestion control mechanisms.
- Analyze different protocols of Application Layer.

TEXTBOOK:

1. Behrouz A. Forouzan, "Data Communications and Networking", Fifth Edition TMH, 2013.

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

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20CS601	BIGDATA ANALYTICS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the introduction of big data and data analytics
- Obtain knowledge related on NoSQL and Hadoop Overview.
- Understand about MongoDB and Cassandra
- Acquire the knowledge in Mapreduce and Hive
- Impart the fundamental concept in Pig

UNIT I BIG DATA AND ANALYTICS 9

Classification of Digital Data - Characteristics of Data - Evaluation of Data - Definition of Big Data - Challenges with Big Data - Traditional Business Intelligence versus Big Data - A Typical Data Warehouse Environment - A Typical Hadoop Environment - Definition of Big Data Analytics - Classification of Analytics - Top Challenges facing Big Data - Data Science and Scientist - Terminologies used in Big Data Environments - Few Top Analytic Tools.

UNIT II BIG DATA TECHNOLOGY LANDSCAPE AND HADOOP 9

NoSQL - Types of NoSQL Database - Advantages of NoSQL - Use of NoSQL in Industry - No SQL Vendors - SQL versus NoSQL - NewSQL - Comparison of SQL,NoSQL and New SQL - Hadoop - Features of Hadoop - Versions of Hadoop - Overview of Hadoop Ecosystems - Cloud Based Hadoop Solutions - RDBMS versus Hadoop - Distributed Computing Challenges - Hadoop Overview - HDFS - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystems.

UNIT III MONGODB AND CASSANDRA 9

MongoDB- Terms used in RDBMS and MongoDB - Data Types in MongoDB - MongoDB Query Language - Cassandra: Features of Cassandra - CQL Data Types - CQLSH - Key Spaces - CRUD -Collections - Using a Counter - TTL - Alter Commands - Import and Export - Query System Tables.

UNIT IV MAPREDUCE PROGRAMMING AND HIVE 9

Mapreduce: Introduction - Mapper - Reducer - Combiner - Partitioner - Searching - Sorting - Compression - HIVE: Hive Architecture - Hive Data Types - Hive File Format - HQL - RCFile Implementation - SerDe - UDF.

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UNIT V PIG 9

Pig: Pig overview - Anatomy of Pig - Pig on Hadoop - Pig Latin overview - Data types in Pig - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data type - UDF - Pig Versus Hive.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the concept of big data and data analytics
- Understand the purpose of using NoSQL and Hadoop.
- Develop simple solutions using MongoDB and Cassandra.
- Understand the concepts of Map reduce and Hive.
- Explain the fundamental concept in Pig

TEXT BOOK:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt.Ltd, 2nd Edition, 2019.

REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", O'Reilly, 4th Edition, 2015.
2. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly, 3rd Edition, 2019.
3. Edward Capriolo, Dean Wampler, Jason Rutherglen, "Programming Hive", O'Reilly, 2nd Edition, 2016.
4. Alex Holmes, "Hadoop in Practice", Manning Publication, 2nd Edition, 2014.
5. WAGmob, "Big Data and Hadoop", Kindle Edition, 2013.
6. Eric Miller, "A Overview of Map Reduce and its impact on Distributed Data", Kindle Edition, 2012.

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20IT301	JAVA PROGRAMMING	L T P C 3 0 2 4

OBJECTIVES:

The Student should be made to:

- Understand the concept of Object Oriented Programming and basics of Java
- Learn the concept of method overloading and inheritance
- Know the principles of packages, interfaces and exception handling
- Develop java programs with the concept of multithreading and I/O
- Design and build Interactive applications

UNIT I OOP AND JAVA FUNDAMENTALS 9

Introduction – Object Oriented Paradigm – Basic Concepts of OOP – Benefits of OOP. Creation of Java – The Java Buzzwords – Data types – Variables – Arrays – Operators – Control Statements – Class Fundamentals – Declaring Objects – Methods – Constructors – this keyword – Garbage Collection.

UNIT II METHOD OVERLOADING AND INHERITANCE 9

Method Overloading – Constructor Overloading – Objects as Parameters – Returning Objects – Recursion – Access Control – static – final – Nested and Inner Class – Inheritance : Basics – super – Multilevel – Hierarchical – Method Overriding – Abstract class – final with Inheritance.

UNIT III PACKAGES, INTERFACES AND EXCEPTION HANDLING 9

Packages – Access Protection – Importing Packages – Interfaces – Default Interface Methods – Static Methods in Interface – Exception Handling Fundamentals – Types – Uncaught Exceptions – Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally. String: String Methods and Operations.

UNIT IV MULTITHREADING PROGRAMMING AND I/O 9

Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads –isAlive and join Methods – Thread Priorities – Synchronization –Interthread Communication – Suspending, Resuming, and Stopping Threads – Obtaining a Thread's State – Using Multithreading – I/O Basics – Reading Console Input – Writing Console Output – The PrintWriter Class – Reading and Writing Files – Automatically Closing a File – Scanner class.

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UNIT V EVENT DRIVEN PROGRAMMING 9

Introducing Graphics – Working with color, font and images – Introduction to AWT – Origins of Swing – Two Key Swing Features – MVC Connection – Components and Containers – The Swing Packages – A Simple Swing Application – Event handling – Creating a Swing Applet – Exploring Swing : JLabel, ImageIcon, JTextField, The Swing Buttons, JScrollPane, JList and JComboBox– Creating Menus.

THEORY: 45 PERIODS

LAB EXPERIMENTS:

1. Program to develop student information system using Class.
2. Inheritance implementation.
3. Implement Inheritance via Interface and Abstract class.
4. Implement a calculator application using package.
5. Develop application using Built-in Exception.
6. Program to implement user defined exception handling.
7. Program to implement File Handling using IO streams.
8. Multi–threaded Programming.
9. Design a calculator using event–driven programming paradigm of Java with the following options.
    a) Decimal manipulations
    b) Scientific manipulations

PRACTICALS: 30 PERIODS

TOTAL: 75 PERIODS

OUTCOMES:

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

- Understand the concept of object oriented programming
- Apply the concepts of inheritance and method overloading in Java programs
- Build Java applications using packages, interfaces and exception handling
- Develop applications for concurrent processing and I/O handling
- Design interactive applications for use on Internet

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TEXT BOOKS:

1. Herbert Schildt, "Java – The Complete Reference", Oracle Press, McGraw Hill Education, 11th Edition, 2019.

REFERENCES:

1. Balagurusamy E, "Programming with Java", McGraw–Hill Education, 6th Edition, 2019.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume – I Fundamentals", Prentice Hall, 10th Edition, 2016.
3. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", Pearson, 3rd Edition, 2015.
4. Steven Holzner, "Java 2 Black book", Dreamtech Press, 2011.
5. T. Budd, "Understanding OOP with Java", Pearson Education, Updated Edition, 2000.

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20MC003	CONSTITUTION OF INDIA	L	T	P	C
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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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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.

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20AD402L **ARTIFICIAL INTELLIGENCE LABORATORY** **L T P C**

0 0 2 1

OBJECTIVES:

The Student should be made to:

- Identify innovative research directions in Artificial Intelligence.
- Apply appropriate algorithms for solving given AI problems.
- Design and implement logical reasoning agents.
- Analyze reasoning systems using either backward orforward inference mechanisms.
- Create sustainable funding models and related efforts.

LIST OF EXPERIMENTS:

1. Study of PROLOG. Write the following programs using PROLOG.
2. Implement propositional logic inferences for AI tasks.
3. Implement resolution based first order logic inferences for AI tasks.
4. Implement classical planning algorithms.
5. Implement A* and memory bounded A* algorithms.
6. Implement genetic algorithms for AI tasks.
7. Solve 8-puzzle problem using best first search.
8. Solve Robot (traversal) problem using means End Analysis.
9. Solve traveling salesman problem.
10. Implement alpha-beta tree search.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Develop code searching techniques to solve the problems.
- Construct code for Robotics Systems.
- Develop a code for analytical skills.
- Develop programs to implement simulated annealing and genetic algorithms.
- Will be able to choose and implement a suitable technics for a given AI task.

List of equipment for a batch of 30 students:

SOFTWARE : C / C++ / Java

HARDWARE: Standalone desktops - 30 Nos.

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20CS603L **DATA ANALYTICS LABORATORY**
(Common to AD, CSE and IT)

L T P C
0 0 2 1

OBJECTIVES:

The Student should be made to:

- Install various tools for big data analysis.
- Write Map Reduce programs for processing big data.
- Realize storage of big data using Mongo DB / Hbase
- Learn about basic Cassandra Query Language.
- Get Introduction on programming tools PIG & HIVE in Hadoop echo system.

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS.
2. Implement word count / frequency programs using MapReduce.
3. Implement an MR program that processes a weather dataset.
4. Deploy MongoDB / HBase and process unstructured data.
5. Create, update and delete data from Cassandra using the Cassandra Query Language (CQL).
6. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
7. Cluster the customers based on buying behaviour using HIVE / Hadoop.
8. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
9. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)

TOTAL: 30 PERIODS

OUTCOMES:

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

- Deploy various tools for big data analysis.
- Solve problem using Map Reduce Technique.
- Process unstructured data in MongoDB / HBase.
- Perform simple taskin Cassandra.
- Develop simple solutions using Pig / Hive.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

Hadoop,Apache HBase, MongoDB, Apache Hive, Apache Cassandra, R Package,

HARDWARE:

Standalone desktops - 30 Nos.

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20EEC401L **LIFE SKILLS AND PERSONALITY DEVELOPMENT**
(COMMON TO ALL BRANCHES)

L	T	P	C
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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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OUTCOME:

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
- Help 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.

REFERENCE BOOK:

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

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20AD501 **BUSINESS ANALYTICS** L T P C

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the analytics life cycle
- Comprehend the process of acquiring business intelligence
- Understand various types of analytics for business forecasting
- Model the supply chain management for analytics
- Apply analytics for different functions of a business

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science - Analytics Life Cycle - Types of Analytics - Business Problem Definition - Data Collection - Data Preparation - Hypothesis Generation - Modeling - Validation and Evaluation - Interpretation - Deployment and Iteration.

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management - Types of Decisions - Decision Making Process - Decision Support Systems - Business Intelligence - OLAP - Analytic functions.

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models - Data Mining and Predictive Analysis Modeling - Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources - Planning and Recruitment - Training and Development - Supply chain network - Planning Demand, Inventory and Supply - Logistics - Analytics applications in HR & Supply Chain.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior - Selling Process - Sales Planning - Analytics applications in Marketing and Sales.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain the real world business problems and model with analytical solutions
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management
- Use analytics for marketing and sales

TEXT BOOK:

1. Evans James R, "Business Analytics", Second Edition, Pearson Education, 2017.

REFERENCES:

1. Prasad R N, Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley Publications, 2016.
2. Philip Kotler and Kevin Keller, "Marketing Management", 15th Edition, PHI, 2016.
3. VSP RAO, "Human Resource Management", 3rd Edition, Excel Books, 2010.
4. Mahadevan B, "Operations Management - Theory and Practice", 3rd Edition, Pearson Education, 2018.

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20AD502 **R PROGRAMMING** **L T P C**

3 0 2 4

OBJECTIVES:

The Student should be made to:

- Understand and able to use basic programming concepts
- Automate data analysis, working collaboratively and openly on code
- Know how to generate dynamic documents
- Able to use a continuous test driven development approach
- Able to implement object oriented programming concepts

UNIT I INTRODUCTION **9**

Overview of R - R data types and objects - reading and writing data - sub setting R Objects - Essentials of the R Language - Installing R - Running R - Packages in R - Calculations - Complex numbers in R - Rounding - Arithmetic - Modulo and integer quotients - Variable names and assignment - Operators - Integers - Factors - Logical operations.

UNIT II CONTROL STRUCTURES AND VECTORS **10**

Control structures - functions - scoping rules - dates and times - Introduction to Functions - preview of Some Important R Data Structures - Vectors - Character Strings - Matrices - Lists - Data Frames - Classes Vectors: Generating sequences - Vectors and subscript - Extracting elements of a vector using subscripts - Working with logical subscripts - Scalars - Vectors - Arrays - and Matrices - Adding and Deleting Vector Elements - Obtaining the Length of a Vector - Matrices and Arrays as Vectors Vector Arithmetic andLogical Operations - Vector Indexing - Common Vector Operations.

UNIT III LISTS **9**

Lists: Creating Lists - General List Operations - List Indexing Adding and Deleting List Elements - Getting the Size of a List - Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists - Data Frames - Creating Data Frames - Accessing Data Frames - Other Matrix-Like Operations.

UNIT IV FACTORS AND TABLES **9**

Factors and Levels - Common Functions Used with Factors - Working with Tables - Matrix/Array-Like Operations on Tables - Extracting a Sub table - Finding the Largest Cells in a Table - Math Functions - Calculating a Probability - Cumulative Sums and Products - Minima and Maxima – Calculus - Functions for Statistical Distributions.

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UNIT V OBJECT-ORIENTED PROGRAMMING 8

S Classes - S Generic Functions - Writing S Classes using Inheritance - Implementing a Generic Function on an S Class - visualization - Simulation - code profiling - Statistical Analysis with R - data manipulation.

THEORY: 45 PERIODS

LAB EXPERIMENTS:

1. Download R programming language SDK and setup to run programs.
2. Develop and write a program to declare R variables, constants, operators and reserved words and understand the operator precedence.
3. Write a program to declare and understand the functioning of all the decision and loop constructs like If-Else, While, Break-Next and Repeat.
4. Execute all R functions.
5. Execute program to demonstrate Vectors, List, Matrix and Data Frames.
6. Execute programs to test R Objects and Class.
7. Write a program to use and display various graphs and charts in R.
8. Execute programs to use plot in R.

PRACTICALS: 30 PERIODS

TOTAL: 75 PERIODS

OUTCOMES:

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

- Study and use basic fundamental concepts to solve the real world problem using R programming language
- Design and implement the solution using scalar, vectors,matrices and statistical problems in R program
- Design and implement the program using data frame,list to provide the solution for various problem
- Study about factors and tables and to solve statistical problems
- Minimize and maximize functions,simulation and visualization and statistical analysis using R

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TEXT BOOKS:

1. Roger D Peng, "R Programming for Data Science", 2012.
2. Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2011.

REFERENCES:

1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014.
2. Venables WN and Ripley, "S programming", Springer, 2000.

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20AD503 **MACHINE LEARNING TECHNIQUES** **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 use cases of ML

UNIT I MACHINE LEARNING BASICS **9**

Introduction to Machine Learning (ML) - Essential concepts of ML - Types of learning - Machine learning methods based on Time - Dimensionality - Linearity and Non linearity - Early trends in Machine learning - Data Understanding Representation and visualization .

UNIT II MACHINE LEARNING METHODS **9**

Linear methods - Regression - Classification - Perceptron and Neural networks - Decision trees - Support vector machines - Probabilistic models - Unsupervised learning - Featurization.

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 MACHINE LEARNING AND DATA ANALYTICS **9**

Machine Learning for Predictive Data Analytics - Data to Insights to Decisions - Data Exploration - Information based Learning - Similarity based learning - Probability based learning - Error based learning - Evaluation - The art of Machine learning to Predictive Data Analytics.

UNIT V APPLICATIONS OF MACHINE LEARNING **9**

Image Recognition - Speech Recognition - Email spam and Malware Filtering - Online fraud detection - Medical Diagnosis.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Study and use the basics of machine learning
- 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'Arey, "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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20AD504	TEXT ANALYTICS	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the methods for keyword extraction from documents
- Learn clustering methods for grouping of documents
- Explore the methods for classification of documents and E-mails
- Explore text visualization techniques and anomaly detection
- Learn about events and trends in text streams

UNIT I TEXT EXTRACTION 9

Introduction - Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords - Benchmark evaluation: precision and recall, efficiency, stop list generation, Evaluation on new articles.

UNIT II DOCUMENT CLUSTERING 9

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms.

UNIT III CONTENT BASED CLASSIFICATION 9

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems.

UNIT IV ANOMALY AND TREND DETECTION 9

Text visualization techniques: Visualization in text analysis, Tag clouds, Authorship and change tracking, Data Exploration and the search for novel patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery. Adaptive threshold setting for novelty mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

UNIT V TEXT STREAMS 9

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LOA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Design text extraction techniques
- Devise clustering techniques for text mining
- Design classification techniques for text mining
- Apply visualization techniques and perform anomaly & trend detection
- Perform Event operations in Text streams

TEXT BOOK:

1. Michael W Berry & Jacob Kogan, "Text Mining Applications and Theory", Wiley publications, 2011.

REFERENCES:

1. CharuC Aggarwal and ChengXiangZhai, "Mining text data", Springer Science & Business Media, 2012.
2. Gary Miner, "Practical text mining and statistical analysis for non-structured text data applications", Academic Press, 2012.
3. Ashok N. Srivastava and MehranSahami, "Text mining: Classification, clustering and applications", Chapman and Hall/CRC, 2009.
4. Paul Buitelaar, Philipp Cimiano and Bernardo Magnini, "Ontology learning from text: methods, evaluation and applications", Vol. 123. IOS press, 2005.

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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.

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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

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 andBagaria 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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20AD505L **MACHINE LEARNING LABORATORY** **L T P C**

0 0 2 1

OBJECTIVES:

The Student should be made to:

- Get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions
- Implement supervised learning and their applications
- Understand unsupervised learning like clustering and EM algorithms
- Understand the theoretical and practical aspects of probabilistic graphical models
- Make use of data sets in implementing the machine learning algorithms

LIST OF EXPERIMENTS:

1. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.
2. Detecting Spam mails using Support vector machine.
3. Implement facial recognition application with artificial neural network.
4. Study and implement Amazon toolkit: Sagemaker.
5. Implement character recognition using Multilayer Perceptron.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Implement sentiment analysis using random forest optimization algorithm.
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.
9. Choose best machine learning algorithm to implement online fraud detection.
10. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Familiarize with recent machine learning algorithms
- Understand the implementation procedures for the machine learning algorithms
- Design Python programs for various machine learning algorithms
- Apply appropriate machine learning algorithms to data sets
- Identify and apply machine learning algorithms to solve real world problems

List of equipment for a batch of 30 students:

SOFTWARE : Python with ML packages

HARDWARE: Standalone desktops - 30 Nos.

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20AD506L	MINI PROJECT-I	L T P C
		0 0 2 1

OBJECTIVES:

The student should be made to:

- Impart knowledge on solving real time problems related to artificial intelligence and data science.
- Explore emerging research issues in solving a specific problem right from its problem identification and literature review till the completion of successful solution.
- Make the students come up with innovative and new ideas in their area of interest.
- Workout with the strategies, to find a solution for addressing the problem in project management.
- Improve effective team building, good coordination and make students to face reviews and viva voce examination.

GUIDELINES FOR REVIEW AND EVALUATION

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

TOTAL: 30 PERIODS

OUTCOMES:

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

- Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.
- Perform literature search in the area of interest.
- Conduct experiments, design and analysis, solution iterations and document the results.
- Perform error analysis and synthesise the results and arrive at scientific conclusions.
- Document the results in the form of technical report and give oral presentation.

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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

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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

TEXT BOOKS:

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

REFERENCES:

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

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20AD601	BASICS OF COMPUTER VISION	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Review image processing techniques for computer vision
- Understand various features and recognition techniques
- Learn about histogram and binary vision
- Apply three-dimensional image analysis techniques
- Study real world applications of computer vision algorithms

UNIT I INTRODUCTION 9

Image Processing, Computer Vision, What is Computer Vision - Low-level, Mid-level, High-level; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution in OpenCV and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT II FEATURE EXTRACTION AND FEATURE SEGMENTATION 9

Feature Extraction - Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis - Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Image Segmentation - Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean -Shift, MRFs, Texture Segmentation.

UNIT III IMAGES, HISTOGRAMS, BINARY VISION 9

Simple pinhole camera model - Sampling - Quantisation - Colour images - Noise - Smoothing - 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering - Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology - Connectivity.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision - projection schemes - shape from shading - photometric stereo - shape from texture - shape from focus - active range finding - surface representations - point-based representation - volumetric representations - 3D object recognition - 3D reconstruction - introduction to motion - triangulation - bundle adjustment - translational alignment - parametric motion - spline-based motion - optical flow - layered motion.

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UNIT V APPLICATIONS **9**

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Virtual Reality and Augmented Reality.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain low level processing of image and transformation techniques applied to images
- Explain the feature extraction, segmentation and object recognition methods
- Apply Histogram transform for detection of geometric shapes like line, ellipse and objects
- Illustrate 3D vision process and motion estimation techniques
- Apply vision techniques to real time applications

TEXT BOOK:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, Second Edition, 2021.
2. Forsyth D A, Ponce J, "Computer Vision: A Modern Approach", Pearson Education, Second Edition, 2015.

REFERENCES:

1. Horn B K P, "Robot Vision", McGraw-Hill, 2015.
2. Simon JD Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
3. Mark Nixon and Alberto S Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
4. Davies E R, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.
5. Reinhard Klette, "Concise Computer Vision: An Introduction into Theory and Algorithms", Springer, 2014.

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20AD602 WEB DEVELOPMENT FUNDAMENTALS L T P C

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand about client-server communication and protocols used during communication
- Design interactive web pages for client side using Scripting languages
- Design interactive web pages for server side using Scripting languages
- Learn server-side programming using JSP and servlets
- Develop web pages using XML/XSLT

UNIT I INTRODUCTION 9

Overview of Internet: Clients, Servers, and Communication, Browser & Web Server Communication- Relative URLs. Protocols - HTTP request message - response message - Web Clients and Web Servers. Markup Languages: XHTML. An Introduction to HTML - Syntax and semantics for writing XHTML - Fundamental Elements HTML - Lists - tables - Frames - Forms - HTML 5.0-Canvas element.

UNIT II CLIENT SIDE TECHNOLOGY 9

Style Sheets: CSS - Introduction to Cascading Style Sheets - Syntax and semantics for CSS-Link - Integration of Style Sheets and HTML - CSS Inheritance, Cascade and Specificity - Border Properties-Box Model Normal Flow Box Layout- CSS3.0. Client-Side Scripting Technique: An Introduction to JavaScript Language - JavaScript in Perspective -Syntax - Variables and Data Types - Conditional and Loops - Events - Functions - Building a Sample Form.

UNIT III SERVER SIDE TECHNOLOGY 9

Server-Side Scripting: Evaluation of PHP - Basic Syntax - Operator and Expression - Functions. JSP Introduction - JSP and Servlets - JavaBeans Classes and JSP-Environment setup for JSP - MVC framework-Database and JSP-Exception handling in JSP. Host Objects: DOM - Introduction to the Document Object Model - Intrinsic Event Handling - Modifying Element Style - The Document Tree and Event Handling - HTML DOM Document hidden Property.

UNIT IV SERVLETS AND XML 9

Java Servlets: Overview - Architecture - Attributes - Servlet Life Cycle - Servlet Request-Event Listener -Session Tracking in Servlet - Servlets for Data Storage and Concurrent Operations - Representing Web Data: XML - Syntax and Semantics for XML - XML Vs

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HTML - XML DTD - XML Schema - XML processing based on DOM. Event based Parsing: SAX - XPATH - XSLT - Displaying XML Documents in Browsers.

UNIT V DYNAMIC WEB INTERACTIONS 9

AJAX: Client Server Architecture - XML Http Request Object methods - Call Back Methods. Web Services: JAX-RPC - WSDL: WSDL Elements - Communicating Object Data: Overview of Java Web Service - Writing a Java Web Service Client - SOAP Related Technologies - Software Installation and Configuration - Procedure for Saving Java Objects as Files.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design simple web pages using markup languages like HTML and XHTML
- Create dynamic web pages using DHTML and java script that is easy to navigate and use
- Program server-side web pages that have to process request from client-side web pages
- Develop web pages using JSP to represent web data using XML
- Understand various web services and how these web services interact

TEXT BOOK:

1. Jeffrey C Jackson, "Web Technologies-A Computer Science Perspective", Pearson Education, 2006.

REFERENCES:

1. Robert W Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
2. Harvey M Deitel, Paul Deitel, Andrew B Goldberg, "Internet& World Wide Web How to Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown, "Core Web Programming", Second Edition, Volume Iand II, Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006.

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20AD603 CLOUD COMPUTING FUNDAMENTALS AND APPLICATIONS

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OBJECTIVES:

The Student should be made to:

- Acquire knowledge about the fundamental concepts of cloud computing
- Gain knowledge on the concept of virtualization
- Be familiar with the cloud platform architectural design
- Learn programming skill in the cloud environment
- Learn about the various cloud security issues

UNIT I INTRODUCTION **7**

Introduction to Cloud Computing - Definition of Cloud - Evolution of Cloud Computing - Hardware Evolution - Internet Software Evolution - Server Virtualization - Principles of Parallel and Distributed Computing - Cloud Characteristics.

UNIT II CLOUD ENABLING TECHNOLOGIES **11**

Service Oriented Architecture - Web Services - Rost and Systems of Systems - Publish Subscribe Model - Basics of Virtualization - Types of Virtualizations - Implementation Levels of Virtualization - Virtualization Structures, Tools and Mechanisms - Virtualization of CPU, Memory and I/O Devices - Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE **8**

Layered Cloud Architecture Design - List Cloud Computing Reference Architecture - Cloud Deployment Model - Public Cloud - Private Cloud - Community Cloud - Hybrid Cloud-Cloud Service Model - Architectural Design Challenges - Cloud Storage.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD **10**

Inter Cloud Resource Management - Resource Provisioning - Resource Provisioning Methods - Global Exchange of Cloud Resources - Security Overview - Cloud Security Challenges - Software-as-a-Service Security - Security Governance - Virtual Machine Security - IAM - Security Standards.

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UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop - MapReduce - VirtualBox - Google App Engine - Programming Environment for Google App Engine - Openstack - Federation in the Cloud - Four Levels of Federation - Federated Services and Applications - Future of Federation.

THEORY: 45 PERIODS

LIST OF EXPERIMENTS:

1. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time in host machine. (Virtual Box or VM Ware or Hyper-V).
2. Setup a Private Cloud Using Open Stack. Develop simple applications and make it available to the intended user.
3. Configure IaaS architecture for installing guest operating system using Eucalyptus.
4. Configure IaaS architecture in Eucalyptus for installing multiple operating systems in same host machine by sharing different core in the same processor.
5. Implementing applications using Google App Engine.
6. To set up the single and multi-node Hadoop cluster in guest operating systems. Demonstrate the use of Map and Reduce tasks using word count program.
7. Study and compare various simulators in cloud computing.

PRACTICALS: 30 PERIODS

TOTAL: 75 PERIODS

OUTCOMES:

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

- Explain the fundamental concepts of cloud computing
- Choose the levels of virtualization and tools for resource provisioning
- Compare the cloud platform architectures of virtualized data centers and Inter Cloud Resource Management
- Propose the standards of Programming Paradigms for improving user Access to Cloud Computing
- Deal with the various cloud security issues

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TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack GDongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013.

REFERENCES:

1. John W Rittinghouse, "Cloud Computing: Implementation, Management and Security", James FRansome, CRC Press 2009.
2. Rajkumar Buyya, James Broberg and Andrzej MGoscinski, "Cloud Computing: Principles and Paradigms", Wiley Publication, 2011.
3. Tim Master, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reily Media, 2009.
4. Jason Venner, "Pro Hadoop – Build Scalable, Distributed Applications in the Cloud", A Press, 2009.
5. Tom White, "Hadoop the Definitive Guide", First Edition, O'Reilly, 2009.

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20AD604L **WEB TECHNOLOGY LABORATORY** **L T P C**

0 0 2 1

OBJECTIVES:

The Student should be made to:

- Design interactive web pages using Scripting languages
- Learn server side programming using servlets and JSP
- Develop web pages using XML/XSLT
- Design web pages usingDOM and SAX parsers
- Develop web application using AJAX

LIST OF EXPERIMENTS:

1. Create a web page with the following using HTML.
   i)To embed an image map in a web page.
   ii) To fix the hot spots.
   iii) Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client-Side Scripts for Validating Web Form Controls using DHTML.
4. Write programs in Java to create three-tier applications using JSP and Databases
   - For conducting on-line examination.
   - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
5. Write programs in Java using Servlets: To invoke servlets from HTML forms. Session Tracking.
6. Installation of Apache Tomcat web server.
7. Programs using XML - Schema - XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Database.

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Design simple web pages using markup languages like HTML and XHTML
- Create dynamic web pages using DHTML and java script that is easy to navigate and use
- Program server side web pages that have to process request from client side web pages
- Develop web pages using JSP to represent web data using XML
- Understand various web services and how these web services interact

List of equipment for a batch of 30 students:

SOFTWARE : Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

HARDWARE: Standalone desktops - 30 Nos.

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20AD605L	MINI PROJECT-II	L T P C
		0 0 2 1

OBJECTIVES:

The Student should be made to:

- Impart knowledge on solving real time problems related to artificial intelligence and data science.
- Explore emerging research issues in solving a specific problem right from its problem identification and literature review till the completion of successful solution.
- Make the students come up with innovative and new ideas in their area of interest.
- Workout with the strategies, to find a solution for addressing the problem in project management.
- Improve effective team building, good coordination and make students to face reviews and viva voce examination.

GUIDELINES FOR REVIEW AND EVALUATION

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

TOTAL: 30 PERIODS

OUTCOMES:

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

- Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.
- Perform literature search in the area of interest.
- Conduct experiments, design and analysis, solution iterations and document the results.
- Perform error analysis and synthesise the results and arrive at scientific conclusions.
- Document the results in the form of technical report and give oral presentation.

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20EEC601L	EMPLOYABILITY SKILLS (Common to all branches)	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 employment skills through modern practices
- Enhance job skills and analytical ability of students
- Improve reasoning skills and employability skills
- Practice the skills on logical reasoning and interview techniques

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

Aptitude - Ratio and Proportion - Partnership - Allegation or Mixtures - Coding 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 ANALAYTICAL 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.

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UNIT V LOGICAL REASONING AND READY RECKNOERS 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 managementskills
- 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

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.

REFERENCE BOOKS:

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 & Schuster New York, 1998.
3. Thomas A Harris, "I'm Ok, You're Ok", Harper and Row New York, 1972.
4. Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications (India) Limited, 2012.
5. Arun Sharma, "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education, Eighth Edition, 2018.

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20AD701 **AI IN ROBOTICS** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study the Robot Locomotion and types of robots
- Explore the kinematic models and constraints
- Learn sensors of robots and image processing for robotics
- Understand the methods for mobile robot Localization
- Study the Path planning and Navigation of Robots

UNIT I ROBOT LOCOMOTION **9**

Introduction to AI and Robotics - robot locomotion - legged mobile robots - wheeled mobile robots - aerial mobile robots.

UNIT II MOBILE ROBOT KINEMATICS **9**

Kinematic models and constraints - mobile robot maneuverability - mobile robot workspace - advanced kinematics - motion control - types of robots.

UNIT III ROBOT PERCEPTION **9**

Sensors for mobile robots - computer vision for robots - image processing for robotics - place recognition - range data.

UNIT IV MOBILE ROBOT LOCALIZATION **9**

Introduction to localization - noise and aliasing - localization-based navigation - belief representation - map representation - probabilistic map-based localization - autonomous map building.

UNIT V ROBOT PLANNING AND NAVIGATION **9**

Planning and navigation - planning and reacting - path planning - obstacle avoidance - navigation architectures.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain the types of Robots
- Narrate the kinematics of Robots
- Implement image processing algorithms
- Devise Localization algorithms
- Devise Path planning methods for navigation

TEXT BOOK:

1. Siegwart R, Nourbaksh I R, and Scarramuzza D, "Introduction to Autonomous Mobile Robots", Second Edition, MIT Press, 2011.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

REFERENCES:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approach", Pearson Education, India, 2016.
2. Negnevitsky M, "Artificial Intelligence: A guide to Intelligent Systems", Harlow: Addison Wesley, 2002.
3. Francis X Govers, "Artificial Intelligence for Robotics", Packt Publishing, 2018.
4. Huimin Lu, Xing Lu, "Artificial Intelligence and Robotics", Springer, 2017.

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20AD702 **DEEP LEARNING TECHNIQUES** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of deep neural networks
- Understand CNN of architectures of deep neural networks
- Understand the concepts of Artificial Neural Networks
- Learn the basics of Data science in Deep learning
- Learn about applications of deep learning in Al and Data Science

UNIT I DEEP NETWORKS BASICS **9**

Linear Algebra: Scalars - Vectors - Matrices and tensors; Probability Distributions - Gradient- based Optimization - Machine Learning Basics: Capacity - Overfitting and underfitting - Hyperparameters and validation sets - Estimators - Bias and variance - Stochastic gradient descent - Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization - Optimization.

UNIT II CONVOLUTIONAL NEURAL NETWORKS **9**

Convolution Operation - Sparse Interactions - Parameter Sharing - Equivariance - Pooling - Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions - Regularization - Optimizers - Gradient Computational.

UNIT III DEEP LEARNING ALGORITHMS FOR Al **9**

Artificail Neural Netowrks - Linear Associative Networks - Perceptrons - The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks - Autoencoders.

UNIT IV DATA SCIENCE AND DEEP LEARNING **9**

Data science fundamentals and responsibilities of a data scientist - life cycle of data science - Data science tools - Data modeling, and featurization - working with data variables and data science tools - Visualize the data - Working with machine learning algorithms and Artificial Neural Networks – Deep learning tools.

UNIT V APPLICATIONS OF DEEP LEARNING **9**

Detection in chest X-ray images - object detection and classification - RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting - building electric

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power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the basics in deep neural networks
- Apply Convolution Neural Network for image processing
- Explain the basics of Artificial Intelligence using deep learning
- Apply deep learning algorithms for data science
- Apply deep learning algorithms for variety applications

TEXT BOOK:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Stone James, "Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019.

REFERENCES:

1. Vance William, "Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science", Joiningthedotstv Limited, Hardcover, 2020.
2. Wani M A, Raj B, Luo F, Dou D (Eds.), "Deep Learning Applications", Volume 3, Springer Publications 2022.
3. Charu C Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.

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20AD703	DATA AND INFORMATION SECURITY	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of Number Theory and Security
- Understand and analyze the principles of different encryption techniques
- Understand the security threats and attacks
- Understand and evaluate the need for the different security aspects in real time applications
- Learn the different applications of information security

UNIT I FUNDAMENTALS OF SECURITY **9**

Computer Security Concepts - Threats, Attacks and Assets - Security Functional - Requirements Fundamental Security Design Principles - Attack Surfaces and Attack Trees. Computer Security Strategy - Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo m and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of F*p, Number in other Bases, Fast Computation of Powers in Z/mZ, Multiplicative Functions, Group Theory, Fields and Problems.

UNIT II ENCRYPTION TECHNIQUES AND KEY MANAGEMENT **9**

Symmetric Encryption Principles - Data Encryption Standard - Advanced Encryption Standard - Stream Ciphers and RC4 - Cipher Block Modes Operation - Digital Signatures - Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange.

UNIT III AUTHENTICATION, INTEGRITY AND ACCESS CONTROL **9**

Authentication: Security Hash Function - HMAC - Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 - Public Key Infrastructure; Access Control: Access Control Principles - Subjects, Objects, and Access Rights - Discretionary Access Control - Example: UNIX File Access Control - Role Based Access Control - Attribute-Based Access Control - Identity, Credential, and Access Management - Trust Frameworks.

UNIT IV CYBER SECURITY **9**

System Security: Firewall, Viruses, Worms, Ransomeware, Keylogger, Greyware, IDS, DDoS Network Security: SSL - TLs - HTTPS -IP Security; OS Security: Introduction to Operating System Security - System Security Planning - Operating Systems Hardening -

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Application Security - Security Maintenance - Linux/Unix Security - Windows Security - Virtualization Security; Wireless Security: Risks and Threats of Wireless - Wireless LAN Security - Wireless Security Policy - Wireless Security Architectures - Wireless security Tools.

UNIT V SECURITY APPLICATIONS **9**

IOT security: Introduction - Architectures - Security challenges - Security requirements - Trust, Data confidentiality, and privacy in IOT - Security in future IOT systems; Cloud Security: Security requirements - Security patterns and Architectural elements - Cloud Security Architecture - Security Management in the Cloud - Availability Management - Saas Availability Management - PaaS Availability Management - laaS Availability Management - Access control - Security Vulnerability, Patch and Configuration Management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the fundamentals of security and the significance of number theory in computer security
- Learn the public key cryptographic standards and authentication scheme
- Able to apply the security frameworks for real time applications
- Understand the security threats and attacks in loT, Cloud
- Able to develop appropriate security algorithms understanding the possible threats

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Fifth Edition, Pearson Education International, 2011.
2. William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education International, 2015.

REFERENCES:

1. Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", Oreilly, 2009.
2. Mikhail Gloukhovtsev, "loT Security: Challenges, Solutions & Future Prospects", Knowledge Sharing Article, Dell Inc, 2018.
3. Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf, "Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence", Springer, 2021.

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20AD704L	DEEP LEARNING LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

The Student should be made to:

- Learn deep neural networks and apply for simple problems
- Learn and apply Convolution Neural Network for image processing
- Learn and apply Recurrent Neural Network and its variants for text analysis
- Augment data using generative models
- Explore real world applications with deep neural networks

LIST OF EXPERIMENTS:

1. Solving XOR problem using Multilayer perceptron.
2. Implement character and Digit Recognition using ANN.
3. Implement the analysis of X-ray image using autoencoders.
4. Implement Speech Recognition using NLP.
5. Develop a code to design object detection and classification for traffic analysis using CNN.
6. Implement online fraud detection of share market data using any one of the data analytics tools.
7. Implement image augmentation using deep RBM.
8. Implement Sentiment Analysis using LSTM.
9. Mini Project: Number plate recognition of traffic video analysis.

TOTAL: 30 PERIODS

OUTCOMES:

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

- Apply deep neural network for simple problems
- Apply Convolution Neural Network for image processing
- Apply Recurrent Neural Network and its variants for text analysis
- Apply generative models for data augmentation
- Develop a real world application using suitable deep neural networks

List of equipment for a batch of 30 students:

SOFTWARE : Understanding on Working of Golab and Transfer Learning Networks

HARDWARE: High end GPU Systems (Huge Computation) - 30 Nos.

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20AD705L	DATA AND INFORMATION SECURITY LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

The Student should be made to:

- Be exposed to the different cipher techniques
- Understand the concept of symmetric key algorithms like DES
- Impart knowledge in public key cryptographic algorithms
- Learn about message authentication and Hash functions
- Learn to use network security tools like GnuPG, KF sensor, Net Strumbler and IPsec VPN

LIST OF EXPERIMENTS:

1. Implement the following Substitution & Transposition techniques concepts:
   a. Caesar Cipher
   b. Playfair Cipher
   c. Hill Cipher
   d. Rail fence – row & Column Transformation
2. Implement the following algorithms
   a. DES
   b. RSA Algorithm
   c. Diffie-Hellman Key Exchange
   d. MD5
3. Implement the SIGNATURE SCHEME – Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honey pot on network (KF Sensor)
6. Installation of root kits and study about the variety of options
7. Demonstrate intrusion detection system (ids) using any tool (snort or any other software)
8. Configure and verify a site-to-site IPSec VPN

TOTAL: 30 PERIODS

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OUTCOMES:

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

- Implement the cipher techniques to applications which offer secure services
- Develop the various security symmetric key algorithms for real time applications
- Illustrate various public key cryptographic algorithms
- Evaluate the authentication and hash function where authentication is required
- Apply different open source tools for network security and analysis

List of equipment for a batch of 30 students:

SOFTWARE:

- C / C++ / Java or equivalent compiler
- GnuPG
- KF Sensor or Equivalent
- Snort
- Net Stumbler or Equivalent
- CISCO IPSec VPN

HARDWARE:

- Standalone desktops – 30 Nos. (or)
- Server supporting 30 terminals or more.

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20AD801L	PROJECT WORK	L T P C
		0 0 20 10

OBJECTIVES:

The Student should be made to:

- Impart knowledge on solving real time problems related to artificial intelligence and data science
- Explore emerging research issues in solving a specific problem right from its problem identification and literature review till the completion of successful solution
- Make the students come up with innovative and new ideas in their area of interest
- Workout with the strategies, to find a solution for addressing the problem in project management
- Improve effective team building, good coordination and make students to face reviews and viva voce examination

GUIDELINES FOR REVIEW AND EVALUATION

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

TOTAL: 300 PERIODS

OUTCOMES:

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

- Identify a problem which needs to provide a sustainable solution using modern tools
- Apply new technical ideas, strategies and methodologies, algorithms, modern techniques that contribute to obtain the solution of the project
- Devise a mechanism to design information and to provide environment friendly solutions
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness
- Document the report for publication and present oral demonstration

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20AD101PE	KNOWLEDGE ENGINEERING	L T P C
	(COMMON TO AD AND CSE)	2 0 2 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of Knowledge Engineering
- Discuss methodologies and modeling for Agent Design and Development
- Design and develop ontologies
- Learn reasoning with ontfologies and rules
- Understand learning and rule learning

UNIT I REASONING UNDER UNCERTAINTY **6**

Introduction - Abductive reasoning - Probabilistic reasoning: Enumerative Probabilities - Subjective Bayesian view - Belief Functions - Baconian Probability - Fuzzy Probability - Uncertainty methods - Evidence-based reasoning - Intelligent Agent - Mixed-Initiative Reasoning - Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING **6**

Conventional Design and Development - Development tools and Reusable Ontologies - Agent Design and Development using Learning Technology - Problem Solving through Analysis and Synthesis - Inquiry-driven Analysis and Synthesis - Evidence-based Assessment - Believability Assessment - Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES - DESIGN AND DEVELOPMENT **6**

Concepts and Instances - Generalization Hierarchies - Object Features - Defining Features - Representation - Transitivity - Inheritance - Concepts as Feature Values - Ontology Matching. Design and Development Methodologies - Steps in Ontology Development - Domain Understanding and Concept Elicitation - Modelling-based Ontology Specification..

UNIT IV REASONIING WITH ONTOLOGIES AND RULES **6**

Production System Architecture - Complex Ontology-based Concepts - Reduction and Synthesis rules and the Inference Engine - Evidence-based hypothesis analysis - Rule and Ontology Matching - Partially Learned Knowledge - Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING **6**

Machine Learning - Concepts - Generalization and Specialization Rules - Types - Formal

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definition of Generalization. Modelling, Learning and Problem Solving- Rule learning and Refinement - Overview - Rule Generation and Analysis - Hypothesis Learning.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Perform operations with Evidence Based Reasoning.
2. Perform Evidence based Analysis.
3. Perform operations on Probability Based Reasoning.
4. Perform Believability Analysis.
5. Implement Rule Learning and refinement.
6. Perform analysis based on learned patterns.
7. Construction of Ontology for a given domain.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Learn the basics of Knowledge Engineering
- Apply methodologies and modeling for Agent Design and Development
- Analyze Design and develop ontologies
- Apply reasoning with ontologies and rules
- Analyze learning and rule learning

TEXT BOOK:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, First Edition, 2016.

REFERENCES:

1. Ronald J Brachman, Hector J Levesque,"Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.
2. Ela Kumar, "Knowledge Engineering", I K International Publisher House, 2018.
3. John F Sowa,"Knowledge Representation: Logical, Philosophical, and Computational Foundations", Brooks/Cole, Thomson Learning, 2000.
4. King, "Knowledge Management and Organizational Learning", Springer, 2009.
5. Jay Liebowitz, "Knowledge Management Learning from Knowledge Engineering", 1st Edition, 2001.

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20AD102PE	RECOMMENDER SYSTEMS	L T P C
	(COMMON TO AD AND IT)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the foundations of the recommender system
- Learn the significance of machine learning and data mining algorithms for Recommender systems
- Learn about collaborative filtering
- Make students design and implement a recommender system
- Learn collaborative filtering

UNIT I INTRODUCTION 9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction - Singular Value Decomposition (SVD).

Suggested Activities:

- Practical learning – Implement Data similarity measures.
- External Learning – Singular Value Decomposition (SVD) applications

Suggested Evaluation Methods:

- Quiz on Recommender systems.
- Quiz of python tools available for implementing Recommender systems

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Suggested Activities:

- Assignment on content-based recommendation systems
- Assignment of learning user profiles

Suggested Evaluation Methods:

- Quiz on similarity-based retrieval.
- Quiz of content-based filtering

UNIT III COLLABORATIVE FILTERING 9

A systematic approach, Nearest-neighbour collaborative filtering (CF), user-based and item-based CF, components of neighbourhood methods (rating normalization, similarity weight computation, and neighbourhood selection.

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Suggested Activities:

- Practical learning – Implement collaborative filtering concepts
- Assignment of security aspects of recommender systems

Suggested Evaluation Methods:

- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction - Types of Attacks - Detecting attacks on recommender systems - Individual attack - Group attack - Strategies for robust recommender design - Robust recommendation algorithms.

Suggested Activities:

- Group Discussion on attacks and their mitigation
- Study of the impact of group attacks
- External Learning – Use of CAPTCHAs

Suggested Evaluation Methods:

- Quiz on attacks on recommender systems
- Seminar on preventing attacks using the CAPTCHAs.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms - User Studies - Online and Offline evaluation - Goals of evaluation design – Design Issues - Accuracy metrics - Limitations of Evaluation measures.

Suggested Activities:

- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Suggested Evaluation Methods:

- Quiz on evaluation design
- Problems on accuracy measures

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basic concepts of recommender systems
- Implement machine-learning and data-mining algorithms in recommender systems data sets
- Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics

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- Design and implement a simple recommender system
- Learn about advanced topics of recommender systems

TEXT BOOK:

1. Charu C. Aggarwal, "Recommender Systems: The Textbook", Springer, 2016.
2. DietmarJannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press, 1st Edition, 2011.

REFERENCES:

1. Francesco Ricci ,LiorRokach , BrachaShapira , "Recommender Sytems Handbook", 1stEdition, Springer, 2011.
2. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rdEdition, Cambridge University Press, 2020.

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20AD103PE FUNDAMENTALS OF NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn the fundamentals of natural language processing
- Gain knowledge of the lexical level processing
- Understand syntactic elements natural language processing
- Understand semantic elements natural language processing
- Understand the ideas of subjectivity and sentiment analysis

UNIT I INTRODUCTION **9**

Regular Expressions: Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence, Words, Corpora, Text Normalization, Minimum Edit Distance. N-gram Language Models: N-Grams - Evaluating Language Models - Sampling sentences from a language model - Generalization and Zeros - Smoothing - Huge Language Models and Stupid Backoff - Advanced: Kneser-Ney Smoothing - Advanced: Perplexity's Relation to Entropy.

UNIT II LEXICAL LEVEL **9**

Computational Morphology, Finite - State Methods for Morphology, Towards syntax: Part-of-speech tagging - Hidden Markov Models for POS Tagging, Viterbi Decoding for HMM, Parameter Learning, Baum Welch Algorithm, Maximum Entropy Models, Conditional Random Fields.

UNIT III SYNTACTIC LEVEL **9**

Syntax Introduction: Constituency, Context - free - grammers. Syntax - Parsing I: Parsing - Top Down vs. Bottom U Dynamic Programming for Parsing Chomsky Normal Form. CKY Algorithm PCFG, Inside-Outside Probabilities. Dependency Grammars and Parsing: Introduction. Transition Based Parsing: Learning Formulation - Arc-eager Parsing, Transition based Parsing. MST-Based Dependency Parsing: Directed Spanning Tree, Maximum Spanning Tree, Chu-Liu Edmonds Algorithm. Feature Representation for Dependency, Online Learning for MST based Parsing.

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UNIT IV SEMANTIC LEVEL 9

Distributional Semantics - Introduction, Distributional Hypothesis, Vector Space Model for Semantics - Distributional Models of Semantics, Applications, Structured Models, Word Embeddings - Part I: Word Vectors, SVD, Vector offsets for Analogy Reasoning. Word Embeddings - Part II: CBOW, Skip - Gram, Glove, Soft Max. Topic Models: Introduction - Latent Dirichlet Allocation: Formulation - Gibbs Sampling for LDA, Applications. Correlated Topic Models, Dynamic Topic Models, Supervised LDA.

UNIT V NLP APPLICATIONS 9

Entity Linking - I (Entity Linking, Wikification, Mention Detection, Link Disambiguation, Key Phraseness, Commonness), Entity Linking - II (Relatedness, Learning to Link). Information Extraction - Introduction, Relation Extraction, Distant Supervision - Distort Supervision, Freebase, Syntactic Dependency Paths. Text Summarization - LEXRANK, Optimization based Approaches for Summarization, Summarization Evaluation, Text Classification. Sentiment Analysis - Introduction, Affective Lexicons, Learning Affective Lexicons, Computing with Affective Lexicons, Aspect - Based Sentiment Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand and explain the approaches for syntax and semantics in NLP
- Understand the concepts of morphology, syntax, semantics and pragmatics of the language
- Apply machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars
- Analyze the current methods for statistical approaches to machine translation
- Compare and contrast the clustering and unsupervised methods, log-linear and discriminative models and the EM algorithm as applied within NLP

TEXT BOOKS:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognitionl", Prentice Hall, 2009.
2. Ian H Witten, Eibe Frank and Mark A Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann, 2013.

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REFERENCES:

1. Christopher Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 2008.
2. James Allen, "Natural Language Understanding", Addison Wesley, 1995.
3. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python - Analyzing Text with the Natural Language Toolkit", O'Reilly Media, Sebastopol, 2009.

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20AD104PE	HEALTH CARE ANALYTICS	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analytics and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analysis for critical care applications

UNIT I INTRODUCTION TO HEALTHCARE ANALYTICS 9

Overview - History of Healthcare analytics Parameters on medical care systems- Health care policy- Standardized code sets - Data Formats - Machine Learning Foundations : Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline - Pre-processing -Visualization - Feature Selection - Training model parameter - Evaluation model : Sensitivity, Specificity, PPV,NPV, FPR, Accuracy, ROC, Precision Recall Curves, Valued target variables -Python: Variables and types, Data Structures and containers, Pandas Data Frame: Operations - Scikit - Learn: Pre-processing, Feature Selection.

UNIT III HEALTH CARE MANAGEMENT 9

IOT- Smart Sensors - Migration of Healthcare Relational database to NoSQL Cloud Database - Decision Support System - Matrix block Cipher System - Semantic Framework Analysis - Histogram bin Shifting and Rc6 Encryption - Clinical Prediction Models - Visual Analytics for Healthcare.

UNIT IV HEALTHCARE AND DEEP LEARNING 9

Introduction on Deep Learning - OFF network CNN- RNN for Sequences - Biomedical Image and Signal Analysis - Natural Language Processing and Data Mining for Clinical Data - Mobile Imaging and Analytics - Clinical Decision Support System.

UNIT V CASE STUDIES 9

Predicting Mortality for cardiology Practice - Smart Ambulance System using IOT - Hospital Acquired Conditions (HAC) program - Healthcare and Emerging Technologies - ECG Data Analysis.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Use machine learning and deep learning algorithms for health data analysis
- Apply the data management techniques for healthcare data
- Evaluate the need of healthcare data analysis in e-healthcare , telemedicine and other critical care applications
- Design health data analytics for real time applications
- Design emergency care system using health data analysis

TEXT BOOKS:

1. Chandan K Reddy, Charu C Aggarwal, "Health Care data Analysis", First Edition, CRC, 2015.

REFERENCES:

1. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
2. Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatt, "Health Care Data Analysis and Management", First Edition, Academic Press, 2018.
3. Hui Jang, Eva KLee, "HealthCare Analysis: From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
4. Kulkarni, Siarry, Singh, Abraham, Zhang, Zumaya, Baki, "Big Data Analytics in HealthCare", Springer, 2020.

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20AD105PE	IMAGE AND VIDEO ANALYTICS	L T P C
		2 0 2 3

COURSE OBJECTIVES:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

UNIT I INTRODUCTION 6

Computer Vision - Image representation and image analysis tasks - Image representations - digitization - properties - color images - Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING 6

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING 6

Object detection - Object detection methods - Deep Learning framework for Object detection - bounding box approach - Intersection over Union (IoU) - Deep Learning Architectures - R-CNN - Faster R-CNN - You Only Look Once (YOLO) - Salient features - Loss Functions - YOLO architectures

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 6

Face Recognition - Introduction - Applications of Face Recognition - Process of Face Recognition - Deep Face solution by Facebook - FaceNet for Face Recognition - Implementation using FaceNet - Gesture Recognition.

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UNIT V VIDEO ANALYTICS **6**

Video Processing - use cases of video analytics - Vanishing Gradient and exploding gradient problem - RestNet architecture - RestNet and skip connections - Inception Network - GoogleNet architecture - Improvement in Inception v2 - Video analytics - RestNet and Inception v3.

30 PERIODS

LIST OF EXERCISES **30 PERIODS**

1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition
7. Write a program for event detection in video surveillance system

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of image processing techniques for computer vision and video analysis.

CO2: Explain the techniques used for image pre-processing.

CO3: Develop various object detection techniques.

CO4: Understand the various face recognition mechanisms.

CO5: Elaborate on deep learning-based video analytics.

TEXT BOOK:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021(UNIT-III, IV and V).

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REFERENCES

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

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20AD106PE ENGINEERING PREDICTIVE ANALYTICS L T P C

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Explain terminology, technology and applications of predictive analysis
- Apply data preparation techniques and generate appropriate association rules
- Discuss various descriptive models, their merits, demerits and application
- Describe various predictive modeling methods
- Introduce the text mining tools, technologies and case study which is used in day-to-day analytics cycle

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics - Setting Up the Problem - Data Understanding - Single Variable - Data Visualization in One Dimension - Data Visualization, Two or Higher Dimensions - The Value of Statistical Significance - Pulling It All Together into a Data Audit.

UNIT II DATA PREPARATION AND ASSOCIATI ON RULES 9

Data Preparation - Variable Cleaning - Feature Creation - Item sets and Association Rules - Terminology - Parameter Settings - How the Data Is Organized - Measures of Interesting Rules - Deploying Association Rules - Problems with Association Rules - Building Classification Rules from Association Rules.

UNIT III MODELLING 9

Descriptive Modeling - Data Preparation Issues with Descriptive Modeling - Principal Component Analysis - Clustering Algorithms - Interpreting Descriptive Models - Standard Cluster Model Interpretation.

UNIT IV PREDICTIVE MODELLING 9

Decision Trees - Logistic Regression - Neural Network Model - K-Nearest Neighbours - Naive Bayes - Regression Models - Linear Regression - Other Regression Algorithms.

UNIT V TEXT MINING 9

Motivation for Text Mining - A Predictive Modeling Approach to Text Mining - Structured vs. Unstructured Data - Why Text Mining Is Hard- Data Preparation Steps - Text Mining Features - Modeling with Text Mining Features- Regular Expressions - Case Studies: Survey Analysis.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the importance of predictive analytics
- Able to prepare and process data for the models
- Ability to model data and establish baseline performance
- Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions
- Illustrate the features and applications of text mining

TEXT BOOKS:

1. Dean Abbott, "Applied Predictive Analytics Principles and Techniques for the Professional Data Analyst", Wiley, 2014.
2. Anasse Bari, Mohammad Chaouchi, Tommy Jung, "Predictive Analytics for Dummies", 2nd Edition, Kindle Edition, 2017.

REFERENCES:

1. Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
4. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.

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20AD107PE COGNITIVE SCIENCE AND ANALYTICS L T P C

3 0 0 3

OBJECTIVE:

The Student should be made to:

- Understand cognitive computing and design principles
- Distinguish between NLP and cognitive computing
- Analyze advanced analytics to cognitive computing
- Discuss application of cognitive computing in business
- Understand various applications of cognitive computing

UNIT I FOUNDATION & DESIGN PRINCIPLES 9

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.

Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

UNIT II NLP IN COGNITIVE SYSTEM 9

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.

Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

UNIT III BIG DATA Vs COGNITIVE COMPUTING 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics.

UNIT IV COGNITIVE COMPUTING IN BUSINESS 9

The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future,

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answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market- IBM Watson as a cognitive systems.

UNIT V APPLICATIONS **9**

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain cognitive computing and design principles
- Describe NLP and cognitive computing
- Apply advanced analytics to cognitive computing
- Apply application of cognitive computing in business
- Illustrate various applications of cognitive computing

TEXT BOOKS:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics", Wiley, 2015.
2. Vijay Raghvan, Venu Govindaraju, Rao C R, "Cognitive Computing: Theory and Applications", by Elsevier publications, North Holland Publication, 1st Edition, 2016.

REFERENCES:

1. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), "Cognitive Approach to Natural Language Processing Hardcover", First Edition May 2017.
2. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., "Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies", 1st Edition, 2018.
3. Min Chen and Kai Hwang, "Big-Data Analytics for Cloud, IoT and Cognitive Computing", Wiley Publication, 1st Edition, 2017.
4. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

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20IT601PE	MOBILE APPLICATION DEVELOPMENT (COMMON TO CSE, IT AND AD)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- To understand Android OS, its application and activities
- To design user interface and develop interface tools
- To implement databases in android application and work with files
- To study about small computing technology and sensors
- To deploy advanced android mobile applications using tools

UNIT I ANDROID OVERVIEW **9**

Introduction - Android SDK features - OHA - Development framework - Getting started - developing for android, mobile devices - ADT - creating an applications and activities - Application manifest - Android Application Life Cycle - Understanding application priority - Externalizing resources - Android application class - Android Activities.

UNIT II USE INTERFACE TOOLS **9**

Creating user interface - Views - creating views - Layouts - Draw able resources - resolution and density independence - Menus - Intents - Adapters - Using Internet resources - Dialogs.

UNIT III FILES, SAVING STATES AND DATABASES **9**

Saving Simple Application Data - creating and saving preferences - preferences activity - saving activity state - loading files - file management tools - Introducing Android databases -SQLite - Cursors and content Values-Working with SQlite Databases-Creating and Using Content providers - Native Android content Providers.

UNIT IV SMALL COMPUTING TECNOLOGY AND SENSORS **9**

Audio, Video Using the Camera - Telephony And SMS - Bluetooth Networks - Managing network connectivity - WI-FI - **Sensors**-Sensors and the Sensor Manager - Interpreting sensor values - Using the compass, Accelerometer and Orientation sensor.

UNIT V ADVANCED ANDROID DEVELOPMENT **9**

Paranoid Android - Using Wake Locks - Introducing Android Text to Speech - AIDL to Support IPC for Services - Building Rich User Interfaces.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand Android Introduction, Applications and Activities
- Creating User interfaces and developing interface tools
- Creating files and databases in android applications
- Understand small computing technology and sensors
- Develop advanced android applications programs using tools

TEXT BOOKS:

1. Reto Meier, "Professional Android 4 Application Development" , Wiley Inc, 2012

REFERENCES:

1. Michael Juntao Yuan, "Enterprise J2ME: Developing Mobile Java Applications", Pearson Education, 2004
2. Knudsen J, "Kicking Butt with MIDP and MSA: Creating Great Mobile Applications" First Edition.
3. James Keogh, "J2ME: The Complete Reference", Tata McGraw-Hill, 2003.

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20AD201PE **CLOUD SERVICES MANAGEMENT** **L T P C**

2 0 2 3

OBJECTIVES:

The Student should be made to:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloudservices
- Select appropriate structures for designing, deploying and running cloud-based services ina business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS **6**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, CloudService Deployment Models.

UNIT II CLOUD SERVICES STRATEGY **6**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driverfor Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

UNIT III CLOUD SERVICE MANAGEMENT **6**

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealingwith Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service CapacityPlanning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud ServiceOperationsManagement.

UNIT IV CLOUD SERVICE ECONOMICS **6**

Pricing models for Cloud Services, Freemium, Pay per Reservation, Pay per User, Subscriptionbased Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

UNIT V CLOUD SERVICE GOVERNANCE & VALUE **6**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, CloudGovernance Structure, Cloud Governance Considerations, Cloud Service Model Risk

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Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, BalancedScorecard, Total Cost of Ownership.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis
3. Create alerts for usage of Cloud resources
4. Create Billing alerts for your Cloud Organization
5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one

TOTAL: 60 PERIODS

OUTCOMES:

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

- Exhibit cloud-design skills to build and automate business solutions using cloud technologies
- Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
- Use strategies to reduce risk and eliminate issues associated with adoption of cloudservices
- Apply structures for designing, deploying and running cloud-based services ina business environment
- Solve the real world problems using Cloud services and technologies.

TEXT BOOK:

1. Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020.
2. Thomas Erl, Ricardo Puttini, Zaigham Mohammad, "Cloud Computing: Concepts, Technology & Architecture",PHI, 2013.
3. Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Pearson, 2017.

REFERENCES:

1. Praveen Ayyappa, "Economics of Cloud Computing", LAP Lambert Academic Publishing, 2020.
2. Rajkumar Buyya, Christian Vechhiola, Thamarai Selvi S, "Mastering Cloud Computing Foundations and Applications Programming", Morgan Kaufmann, 2013.

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20IT706PE	USER INTERFACE DESIGN (COMMON TO AD, CSE AND IT)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study basics of user interface design
- Study user experience design process
- Understand the basis concept of UX analysis and research
- Gain knowledge about UX design principles and patterns
- Learn about UX evaluation and implementation

UNIT I USER INTERFACE DESIGN PROCESS **9**

Introduction to user interface design -User interface Design Process - Obstacles - Usability - Human Characteristics in Design - Human Interaction Speed - Business Functions - Requirements Analysis - Direct and Indirect methods - Basic Business Functions - Design Standards - System Training - Human Consideration in Screen Design.

UNIT II UX DESIGN BASICS **9**

Evolution of design - Creative Thinking and Problem Solving - Elements of Design - Principles of Design - Design articulation - Introduction to UX Design - User Centered Design Process - Popular UX Frameworks.

UNIT III UX ANALYSIS AND RESEARCH **9**

Research methodology - Contextual Enquiry - Data capturing - Consolidating and Analyzing - Understanding Stakeholders - Users and Competition - User Segmentation: Profiles and Personas.

UNITIV UX DESIGN PRINCIPLES AND PATTERNS **9**

UX Design principles - Design Ideation - Information Architecture : Card Sort - Interaction Modeling : Scenarios and Storyboards - Information Design - Visual Design Concepts : Grid System and Page Layouts - Visual Hierarchy - Typography - Color - Iconography - Brand Identity.

UNIT V UX EVALUATION AND IMPLEMENTATION **9**

Introduction to Usability Evaluation - Usability Heuristics - Evaluation Methods : Heuristic Evaluation - Usability Testing - Accessibility - Digital Devices / Usage Environments - Multichannel delivery possibilities and UX Technologies.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Study the concept of user interface design process
- Gain knowledge about various user experience design process
- Learn the UX analysis and research
- Gain knowledge about UX design principles
- Learn about various evaluation methods

TEXT BOOK:

1. EmrahYayici, "UX Design and Usability Mentor Book: With Best Practice Business Analysis and User Interface Design Tips and Techniques", Emrah Yayici, First Edition, 2014.

REFERENCES:

1. Jesse James Garrett, "The Elements of User Experience: User-Centered Design for the Web and Beyond", New Riders, Edition 2011.
2. Kevin Nichols, Donald Chesnut, "UX for Dummies", John Wiley & Sons, 1st Edition 2014.
3. Jeffrey Rubin, Dana Chisnell, "Handbook of Usability Testing: How to Plan, Design and Conduct Effective Tests", Wiley India, 2nd Edition, 2011.
4. http://nptel.ac.in/syllabus/107104079/.

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20CS701PE	SOFTWARE TESTING (COMMON TO CSE, ECE, IT AND AD)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the basics of testing graphs
- Design Data flow graphs for testing software
- Understand Graph Coverageto test code
- Know the basics of Mutation testing and operators
- Test web applications and Object oriented Applications

UNIT I INTRODUCTION 9

Terminologies - Testing based on Models and Criteria - Automation - Basics of Graphs - Structural Graph Coverage Criteria - Elementary Graph Algorithms.

UNIT II DATA FLOW GRAPHS 9

Data flow graphs - Algorithms: Data flow graphs coverage Criteria - Graph coverage - Criteria: Applied to test code - Testing Source code: Classical Coverage criteria.

UNIT III BASICS OF TESTING 9

Software design and Integration Testing - Design Integration Testing and Graph Coverage - Specification Testing and Graph Coverage - Graph Coverage and Finite state machines - Basics needed for testing - Logic: Coverage Criteria - Applying to test code - Issues in applying to test code - Applied to test specifications - Applied to finite state machines.

UNIT IV TESTING METHODOLOGIES 9

Functional testing - Input space partitioning - Input space partitioning: Coverage criteria, Example - Syntax based testing - Mutation testing - Mutation testing for programs - Mutation operators for source code - Mutation testing vs Graphs and logic based testing - Mutation for Integration - Grammars and Inputs.

UNIT V TESTING WEB AND OBJECT ORIENTED APPLICATIONS 9

Testing of web applications and Web services - Testing of Object oriented Applications - Symbolic testing - Directed automated Random Testing - Testing of object oriented applications - Testing of mobile applications - Non-functional system testing - Regression testing.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Able to apply specific (automated) testing method to the projects
- Distinguish characteristics of structural testing methods
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible
- Learn about the functional and system testing methods
- Demonstrate various issues for object oriented testing

TEXT BOOK:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

REFERENCES:

1. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance: Theory and Practice", wiley publication, 2011.
2. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
3. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
4. Aditya P Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
5. https://nptel.ac.in/courses/106/101/106101163/#
6. Prof. Meenakshi D'Souza, "Software Testing", NPTEL book, 2020.

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20AD202PE	WEB APPLICATION SECURITY	L T P C
	(COMMON TO AD AND IT)	2 0 2 3

OBJECTIVES:

The Student should be made to:

- Understand the fundamentals of web application security
- Focus on wide aspects of secure development and deployment of web applications
- Learn how to build secure APIs
- Learn the basics of vulnerability assessment and penetration testing
- Get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 5

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM).

UNIT III SECURE API DEVELOPMENT 6

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 7

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

30 PERIODS

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PRACTICAL EXERCISES: **30 PERIODS**

1. Install wireshark and explore the various protocols
    a. Analyze the difference between HTTP vs HTTPS
    b. Analyze the various security mechanisms embedded with different protocols.
2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation. GET
    a. PUSH
    b. POST
    c. DELETE
4. Install Burp Suite to do following vulnerabilities: . SQL injection
    a. cross-site scripting (XSS)
5. Attack the website using Social Engineering method

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understanding the basic concepts of web application security and the need for it
- Be acquainted with the process for secure development and deployment of web applications
- Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- Be able to get the importance of carrying out vulnerability assessment and penetration testing
- Acquire the skill to think like a hacker and to use hackers tool sets

TEXT BOOK:

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, "Web Application Security: A Beginners Guide", 2012, The McGraw-Hill Companies.
3. Neil Madden, "API Security in Action", 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, "Developer's Guide to Web Application Security", 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, "Testing and Securing Web Applications", 2021, Taylor &Francis Group, LLC.

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3. Prabath Siriwardena, "Advanced API Security", 2020, Apress Media LLC, USA.
4. Malcom McDonald, "Web Security for Developers", 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat, "Hacking: The Ethical Hacker's Handbook", Third Edition, 2011, TheMcGraw-Hill Companies.

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20AD203PE	DEVOPS	L T P C
	(COMMON TO AD AND IT)	2 0 2 3

OBJECTIVES:

The Student should be made to:

- Introduce DevOps terminology, definition & concepts
- Understand the different Version control tools like Git, Mercurial
- Understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- Understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I INTRODUCTION TO DEVOPS **6**

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE **6**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

UNIT III CONTINUOUS INTEGRATION USING JENKINS **6**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNITIV CONFIGURATION MANAGEMENT USING ANSIBLE **6**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE **6**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

30 PERIODS

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PRACTICAL EXERCISES: **30 PERIODS**

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud
4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle
8. Install Ansible and configure ansible roles and to write playbooks

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand different actions performed through Version control tools like Git
- Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven &Gradle
- Ability to Perform Automated Continuous Deployment
- Ability to do configuration management using Ansible
- Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOK:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

REFERENCES:

1. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
2. Mariot Tsitoara, "Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

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20IT707PE	HUMAN COMPUTER INTERACTION (COMMON TO AD, CSE AND IT)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand fundamentals of human computer interaction
- Design various models for interaction
- Learn design techniques and fundamentals of Human Computer Interaction
- Know various types of existing interfaces and evaluation techniques
- Understand applications of HCI in emerging trends

UNIT I INTRODUCTION - THE HUMAN AND COMPUTER 9

The Human: Introduction - Input /Output Channels - Human memory - Thinking: reasoning and problem solving - Individual differences - Psychology and the design of interactive systems - The computer: Introduction - Text entry devices - Positioning - Pointing and drawing - Paper: printing and scanning - Memory - Processing and networks.

UNIT II INTERACTION AND INTERFACES 9

The Interaction: Introduction - Models of interaction - Frameworks and HCI - Ergonomics - Interaction styles - Elements of the WIMP interface - Interactivity - The context of the interaction - Experience - Engagement and fun - Paradigms: Introduction - Paradigm for interaction

UNIT III DESIGNING RULES 9

Interaction design basics: Introduction - The process of design - User focus - Scenarios - Navigation design - Screen design and layout - Iteration and Prototyping - HCI in the software process: Introduction - The software life cycle - Usability engineering - Iterative design and prototyping - Design rationale - Design rules: Introduction - Principles to support usability - Standards - Guidelines - Golden rules and heuristics - HCI patterns.

UNIT IV MODELS AND EVALUATION FRAMEWORK 9

Cognitive models: Introduction - Goal and task hierarchies - Linguistic models - The challenge of display - based systems - Physical and device models - cognitive architecture - Communication and collaboration model: Introduction - Face-to-face communication - Conversation - Text-based communication - Group working - Models of the system: Introduction - Standard Formalism - Interactive models - Continuous behavior.

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UNIT V INTERFACING APPLICATIONS 9

Groupware: Introduction - Groupware systems - Computer - mediated communication - Meeting and decision support systems - Shared applications and artifacts - Frameworks for groupware - Implementing synchronous groupware - Hypertext - multimedia and the World Wide Web: Introduction - Understanding hypertext - Finding things - Web technology and issues - Static web content - Dynamic web content.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the requirements and specifications for the interaction design.
- Analyze the evaluation techniques of human interaction.
- Determine the most appropriate HCI methods to meet the needs of a practical software development Project.
- Identify, analyzes, formulate and solve engineering problems.
- Understand the impact of engineering solutions in a global, economic, environmental and societal context.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory D Abowd and Russell Beale, "Human-Computer Interaction", Prentice Hall, 3rd Edition, 2008.

REFERENCES:

1. Preece J, Rogers Y, Sharp H, Benyon D, Holland S and Carey T, "Human-Computer Interaction", Addison Wesley, 1994.
2. Andrew Sears, Julie A Jacko, "The Human-Computer Interaction Handbook Fundamentals, Evolving Technologies and Emerging Applications", 2nd Edition, Taylor & Francis Group, 2008.
3. Claude Ghaoui, "Encyclopaedia of Human Computer Interaction", Wiley, 2000.

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20AD301PE **VIRTUALIZATION** **L T P C**

2 0 2 3

OBJECTIVES:

The Student should be made to:

- Learn the basics and types of Virtualization
- Understand the Server and desktop Virtualization
- Understand the Hypervisors and its types
- Explore the Virtualization Solutions
- Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION **6**

Virtualization and cloud computing - Need of virtualization - cost, administration, fast deployment, reduce infrastructure cost - limitations - Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization - Types of Hypervisors.

UNIT II SERVER AND DESKTOP VIRTUALIZATION **6**

Virtual machine basics - Types of virtual machines - Understanding Server Virtualization - types of server virtualization - Business Cases for Server Virtualization - Uses of Virtual Server Consolidation - Selecting Server Virtualization Platform-Desktop Virtualization - Types of Desktop Virtualization.

UNIT III NETWORK VIRTUALIZATION **6**

Introduction to Network Virtualization - Advantages - Functions-Tools for Network Virtualization - VLAN-WAN Architecture-WAN Virtualization.

UNIT IV STORAGE VIRTUALIZATION **6**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization - SAN - NAS-RAID.

UNIT V VIRTUALIZATION TOOLS **6**

VMWare - Amazon AWS - Microsoft HyperV - Oracle VM Virtual Box - IBM PowerVM - Google Virtualization- Case study.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.

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2. a.Shrink and extend virtual disk

   b. Create, Manage, Configure and schedule snapshots

   c. Create Spanned, Mirrored and Striped volume

   d. Create RAID 5 volume

3. a.Desktop Virtualization using VNC

   b.Desktop Virtualization using Chrome Remote Desktop

4. Create type 2 virtualization on ESXI 6.5 server

5. Create a VLAN in CISCO packet tracer

6. Install KVM in Linux

7. Create Nested Virtual Machine(VM under another VM)

TOTAL: 60 PERIODS

OUTCOMES:

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

- Analyse the virtualization concepts and Hypervisor
- Apply the Virtualization for real-world applications
- Install & Configure the Network Virtualization
- Install & Configure the Storage Virtualization
- Experiment with the VM with various software

TEXT BOOKS:

1. Anthony T Velte , Toby J Velte Robert Elsenpeter, "Cloud computing a practical approach",TATA McGraw Hill, New Delhi, 2010.
2. RajkumarBuyya, James Broberg, Andrzej Goscinski, "Cloud Computing (Principles and Paradigms)", John Wiley & Sons, Inc. 2011.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

REFERENCES:

1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

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20AD302PE	DATA WAREHOUSING	L T P C
		3 0 0 3

OBJECTIVE:

The Student should be made to:

- Know the details of data warehouse Architecture
- Understand the OLAP Technology
- Understand the partitioning strategy
- Differentiate various schema
- Understand the roles of process manager & system manage

UNIT I INTRODUCTION TO DATA WAREHOUSE 9

Data warehouse Introduction - Data warehouse components - operational database Vs data warehouse - Data warehouse Architecture - Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse.

UNIT II ETL AND OLAP TECHNOLOGY 9

What is ETL - ETL Vs ELT - Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III META DATA, DATA MART AND PARTITION STRATEGY 9

Meta Data - Categories of Metadata - Role of Metadata - Metadata Repository - Challenges for Meta Management - Data Mart - Need of Data Mart - Cost Effective Data Mart - Designing Data Marts - Cost of Data Marts- Partitioning Strategy - Vertical partition - Normalization - Row Splitting - Horizontal Partition.

UNIT IV DIMENSIONAL MODELING AND SCHEMA 9

Dimensional Modeling - Multi-Dimensional Data Modeling - Data Cube - Star Schema - Snowflake schema - Star Vs Snowflake schema - Fact constellation Schema - Schema Definition - Process Architecture - Types of Data Base Parallelism - Data warehouse Tools.

UNIT V SYSTEM & PROCESS MANAGERS 9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager - Warehouse Manager - Query Manager - Tuning - Testing.

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TOTAL: 45 PERIODS

OUTCOMES:

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

- Design data warehouse architecture for various Problems
- Apply the OLAP Technology
- Analyse the partitioning strategy
- Critically analyze the differentiation of various schema for given problem
- Frame roles of process manager & system manage

TEXT BOOKS:

1. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third Edition, 2013.
2. Alex Berson and Stephen Smith J, "Data Warehousing, Data Mining & OLAP", Tata McGraw - Hill Edition, 35th Reprint, 2016.

REFERENCES:

1. Soman K P, Shyam Diwakar and Ajay V, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, Second Edition, 2011.
3. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.

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20AD303PE	STORAGE TECHNOLOGIES	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS **9**

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID **7**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture.

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION **11**

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION **10**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of

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replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V SECURING STORAGE INFRASTRUCTURE 8

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
- Illustrate the usage of advanced intelligent storage systems and RAID
- Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
- Examine the different role in providing disaster recovery and remote replication technologies
- Infer the security needs and security measures to be employed in information storage management

TEXT BOOKS:

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, "Introduction to Storage Area Networks", Ninth Edition, IBM - Redbooks, December 2017.
2. Somasundaram G, Alok Shrivastava, EMC Corporation, "Information Storage and Management", Wiley, India, 2009.

REFERENCES:

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained", Second Edition, Wiley, 2009.

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20IT807PE **SOFTWARE DEFINED NETWORKS**

(Common to AIDS and IT)

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Acquire the fundamentals of software defined networks.
- Explore Open Flow specifications and SDN controllers for building Software defined networks.
- Study the concept of Programming in in network devices and controllers.
- Learn the constructs that are used to create, run, maintain, and manage multitenant data centers
- Study about building an SDN Framework.

UNIT I INTRODUCTION 9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Genesis of SDN – How SDN Works – Centralized and Distributed Control and Date Planes.

UNIT II OPEN FLOW & SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT III NETWORK PROGRAMMABILITY 9

Introduction – Management Interface – Application-Network Divide – Modern Programming Interface – Modern Orchestration.

UNIT IV DATA CENTERS 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE.

UNIT V BUILDING AN SDN FRAMEWORK 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Bandwidth Calendaring – Data Center Orchestration.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain the fundamentals of software defined networks.
- Explore Open Flow specifications for building Software defined networks.
- Implement the programming among network devices and controllers for their interaction.
- Create, run, maintain, and manage multitenant data centers.
- Build an SDN framework.

TEXT BOOKS:

1. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", Second Edition, Morgan Kaufmann, 2016.
2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

REFERENCES :

1. Siamak Azodolmolky, "Software Defined Networking with Open Flow", Packet Publishing, 2013.
2. Vivek Tiwari, "SDN and Open Flow for Beginners", Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.

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20AD304PE	SECURITY AND PRIVACY IN CLOUD	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Introduce Cloud Computing terminology, definition & concepts
- Understand the security design and architectural considerations for Cloud
- Understand the Identity, Access control in Cloud
- Follow best practices for Cloud security using various design patterns
- Able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 10

Security design principles for Cloud Computing - Comprehensive data protection - End-to-End access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

UNIT IV CLOUD SECURITY DESIGN PATTERNS 8

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing - Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services,

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Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the cloud concepts and fundamentals
- Explain the security challenges in the cloud
- Define cloud policy and Identity and Access Management
- Understand various risks and audit and monitoring mechanisms in the cloud
- Define the various architectural and design considerations for security in the cloud

TEXT BOOKS:

1. Raj Kumar Buyya, James Broberg, AndrzejGoscinski, "Cloud Computing", Wiley 2013.
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand, 2013.
3. Mather. Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY, 2011

REFERENCES:

1. Mark C. Chu-Carroll, "Code in the Cloud", CRC Press, 2011.

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20CS503PE	DISTRIBUTED SYSTEMS (COMMON TO CSE, IT AND AD)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn about the basic concepts of communication in Distributed environment
- Understand the Synchronization and transaction in distributed environment
- Understand the Resource management in distributed environment
- Learn fault tolerance and security in distributed system
- Design and implement distributed applications

UNIT I COMMUNICATION IN DISTRIBUTED ENVIRONMENT **9**

Introduction - Examples of Distributed Systems - Focusing on resource Sharing - Challenges - API for Internet Protocol - External Data Representation and Marshaling - Multicast communication - Remote Procedure Call - Group Communication - Publish - subscribe systems.

UNIT II PROCESS AND SYNCHRONIZATION **9**

Processes - Threads - Communication and Invocation - Clocks, Events and Process States - Synchronization Physical Clocks - Logical Time and Logical Clocks - Global States - Distributed Mutual Exclusion - Elections - Distributed Transactions.

UNIT III PEER TO PEER SERVICES **9**

Introduction - Napster and its legacy - Peer-to-peer middleware - Routing Overlay - case studies: Pastry, Tapestry - Digital signatures - Distributed debugging.

UNIT IV FAULT TOLERANCE AND SECURITY **9**

Fault Tolerant Services - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Distributed Deadlocks - Transaction Recovery - Overview of security techniques - Access Control - Cryptography Algorithms - Kerberos.

UNIT V CASE STUDIES **9**

Distributed Object Based System - CORBA - Distributed File System - Sun NFS - Andrew File System - Enterprise Java Beans- Fractals - JINI.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Identify the Problems in Developing Distributed Application
- Recognize Feasibilities and Impossibilities in Managing Resources
- Distinguish the theoretical and conceptual foundation of distributed computing
- Recognize the inherent difficulties that arise due to distributedness of computing resources
- Design and implement projects both individually and as part of a team

TEXT BOOK:

1. George Colouris, Jean Dollimore and Tim Kinberg, "Distributed system concept and Design", Pearson Education, 4th Edition, 2012.

REFERENCES:

1. Tanenbaum A S, "Distributed Operating Systems", Pearson Education, 2011.
2. Sunita Mahajan and Seema Shah, "Distributed Computing", Oxford Higher Education, 2010.
3. Tanenbaum A S and Van Steen M, "Distributed Systems Principles and Paradigm", Pearson Education, 2007.
4. Ajay D Kshemkalyani and Mukaeshsinghal, "Distributed Computing Principles Algorithms & Systems", Cambridge University press, 2010.

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20CS705PE	INFORMATION RETRIEVAL TECHNIQUES (COMMON TO AD, CSE AND IT)	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basics of Information Retrieval
- Learn the information retrieval models
- Understand various search engine system operations
- Learn about link analysis and search
- Understand machine learning techniques for text classification and clustering

UNIT I INTRODUCTION 9

Motivation - Information versus Data Retrieval - Basic Concepts - Early Developments - Information retrieval in the library - Practical Issues - Retrieval Process - Models for browsing.

UNIT II INFORMATION RETRIEVAL MODELS 9

Boolean retrieval Model - Vector space Model - Term frequency and Weighting - Variant functions - Efficient scoring and Ranking - Components of an information retrieval system - Relevance feedback and pseudo relevance feedback - The Probability Ranking Principle - Binary Independence Model - query likelihood model - Language Models.

UNIT III WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING 9

Web search basics - Background and history - Web characteristics - The search user experience- Index size and estimation - Near-duplicates and shingling - Index compression - Web crawling and indexes - Overview - Crawling - Crawler architecture - Distributing indexes - Connectivity servers - XML retrieval

UNIT IV LINK ANALYSIS AND SPECIALIZED SEARCH 9

Link Analysis - The Web as a graph - Page Rank - Markov chains - The Page Rank computation - hubs and authorities - Choosing the subset of the Web.

UNIT V DOCUMENT TEXT MINING 9

Text classification and Naive Bayes - The text classification problem - Naive Bayes text classification - The Bernoulli model - Evaluation of text classification - Rocchio classification - k nearest neighbor - Flat clustering - Clustering in information retrieval - K-means - Model-based clustering - Hierarchical clustering - Group-average agglomerative clustering - Centroid clustering - Optimality of HAC .

TOTAL: 45 PERIODS

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OUTCOMES:

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

- To describe the concepts, architecture, characteristics of Information retrieval and search engines
- To apply the traditional IR models for searching text to acquire useful information
- To apply various indexing techniques and querying operations to speed up the task of matching documents to queries
- To use searching and ranking techniques of various IR models to rank the documents retrieved
- To choose suitable classification and clustering algorithms for retrieval of valuable information from web documents

TEXT BOOKS:

1. Ricardo Baeza - Yates, Berthier Ribeiro - Neto, "Modern Information Retrieval: The concepts and Technology behind Search", Addison Wesley, Second Edition 2011.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition 2012. (Classification and Clustering)

REFERENCES:

1. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
2. Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", 1st Edition Addison Wesley, 2010.

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20AD401PE	CYBER SECURITY AND PRIVACY	L T P C
	(COMMON TO AD AND IT)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Study the Introduction and basics of cyber security
- Know about the security management aspects of cyber security
- Explore Cryptography, IDS, IPS and EU's GDPR
- Study the privacy principles and policies
- Know about the Economics of security and privacy

UNIT I INTRODUCTION TO CYBER SECURITY **9**

Foundations, cyber security, information security and related concepts, Principles of information security management, Confidentiality, Integrity, Availability and related concepts.

UNIT II SECURITY MANAGEMENT **9**

Security management, Governance, Risk and Compliance (GRC), Contingency planning, incidence response, disaster recovery and business continuity. Understanding security policy, security behavior , Risk management: Risk identification, threat modeling, strategies.

UNIT III CONTROL STRATEGIES **9**

Control strategies and protection mechanisms (Guest lecture), Cryptography for security. Information security and privacy, Regulatory landscape: Fair information practices, US regulatory frameworks. Regulatory landscape: EU's GDPR and its implications and other privacy and cyber security regulations, Cyber security and privacy in the Indian context, evolution and issues.

UNIT IV INVESTIGATION IN CYBER SECURITY **9**

Investigation Methods, Criminal Profiling, Cyber Trails, Digital Forensics, History, Challenges, Branches of Digital Forensics, Digital Forensic Investigation Methods, Reporting, Management of Evidence, Cyber Law-Basics, Information Technology Act 2000, Amendments to IT Act 2000.

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UNIT V ECONOMICS OF PRIVACY 9

Introduction to Economics of privacy, privacy calculus and trade-offs, privacy paradox, Managing stakeholders, making choices on security and privacy

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the basic concepts of cyber security and privacy.
- Implementation of security management aspects of cyber security.
- Explore Cryptography and control strategy of cyber security.
- Devise privacy principles and policies.
- Manage the Economics of privacy.

TEXT BOOK:

1. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", 6th Edition, Cenage Learning, N. Delhi. 2018.
2. Van Kessel P, "Is cyber security about more than protection?", EY Global Information Security Survey, 2018-2019.

REFERENCES:

1. Johnston A.C. and Warkentin M, "Fear appeals and information security behaviors: An empirical study", MIS Quarterly, 2010.
2. Arce I. et al., "Avoiding the top 10 software security design flaws", IEEE Computer Society Center for Secure Design (CSD), 2014.
3. Smith H. J., Dinev T., & Xu, H. "Information privacy research: an inter disciplinary review", MIS Quarterly, 2011.
4. Subramanian R "Security, privacy and politics in India: a historical review", Journal of Information Systems Security (JISSec), 2010.
5. Acquisti A, John L. K., & Loewenstein G, "What is privacy worth? The Journal of Legal Studies", 2013.
6. Xu H, Luo X.R, Carroll J.M, Rosson M.B, "The personalization privacy paradox: An exploratory study of decision making process for location-aware marketing", Decision Support Systems, 2011.

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20AD402PE	DIGITAL FORENSICS	L T P C
		3 0 0 3

OBJECTIVE:

The Student should be made to:

- Learndigital forensics and investigation process
- Become familiar withdigital forensic tools
- Learn to analyze and validate windows forensics data
- Identify the network infrastructure
- Analyze the wireless and web attacks

UNIT I INTRODUCTION TO DIGITAL FORENSICS **9**

Definition of Computer Forensics, Cyber Crime, Evolution of Computer Forensics, Objectives of Computer Forensics, Roles of Forensics Investigator, Forensics Readiness, Steps for Forensics. Digital Forensics Investigation Process, Digital Forensics Investigation Process-Assessment Phase, Acquire the Data, Analyze the Data, Report the Investigation.

UNIT II DIGITAL EVIDENCAND FORENSICS TOOLS **9**

Digital Evidence, Digital Evidence Investigation Process, First Responders Toolkit, Issues Facing Computer Forensics, Types of Investigation, Techniques in digital forensics, The Booting Process, LINUX Boot Process, Mac OS Boot Sequence, Windows 10 Booting Sequence, File System, Type of File Systems.

UNIT III WINDOWS FORENSICS **9**

Introduction to Windows Forensics, Windows Forensics Volatile Information, Windows Forensics Non-Volatile Information, Recovering deleted files and partitions, Windows Forensics Summary, Digital Forensics Road map: Static Data Acquisition from windows using FTK Imager, Live Data Acquisition using FTK Imager, FTK Imager, Installation of KALI Linux, RAM Dump Analysis using Volatility, Static Data Acquisition from Linux OS. Digital Forensics Tools, Overview of EnCase Forensics, Deep Information Gathering Tool: Dmitry Page, Computer Forensics Live Practical by using Autopsy and FTK Imager.

UNIT IV NETWORK FORENSICS **9**

Introduction to Network Forensics, Network Components and their forensic importance, OSI internet Layers and their Forensic importance, Tools Introduction Wireshark and TCPDUMP, Packet Sniffing and Analysis using Ettercap and Wireshark, Network Forensics, Wireshark Packet Analyzer, Packet Capture using TCP DUMP, Website Penetration: WHOIS, nslookup. Forensic Analysis using AUTOPSY: Linux and Windows, Forensics and Log analysis,

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Compare and AUDIT Evidences using Hashdeep Page, Data Carving using Bulk Extractor: Kali Linux and Windows, Recovering Evidence from Forensic Images using Foremost. Introduction to Password Cracking, Password Cracking using John the Ripper, Password Cracking using Rainbow Tables, PDF File Analysis, Remote Imaging using E3 Digital Forensics.

UNIT V WIRELESS AND WEB ATTACKS **9**

WiFi Packet Capture and Password Cracking using Aircracking, Introduction to Web Attacks, Website Copier: HTTRACK, SQL Injection, Site Report Generation: Netcraft, Vulnerability Analysis: Nikto, Wayback Machine, Deep Information Gathering Tool: Dmitry, Image Metadata Extraction using Imago. Email Forensics Investigations, Mobile Forensics, Preparation for Digital Forensic investigation, Introduction to Report Writing, Forensic Reports & Expert Witness, Demonstration of Some Forensics Tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basics of digital forensics
- Apply a number of different digital forensic tools to a given scenario
- Analyze and validate windows forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security

TEXT BOOKS:

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
2. MarjieTBritz, "Computer Forensics and Cyber Crime: An Introduction", 3rdEdition, Prentice Hall, 2013.
3. AnkitFadia, "Ethical Hacking" Second Edition, Macmillan India Ltd, 2006.
4. Kenneth C Brancik, "Insider Computer Fraud", Auerbach Publications Taylor & Francis Group–2008.
5. https://www.uou.ac.in/progdetail?pid=MSCCS-21

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20AD403PE	MODERN CRYPTOGRAPHY	L T P C
		2 0 2 3

OBJECTIVES:

The student should be made to:

- Learn about Modern Cryptography
- Focus on how cryptographic algorithms and protocols work and how to use them
- Build a pseudorandom permutation
- Construct Basic cryptanalytic techniques
- Provide instruction on how to use the concepts of block ciphers and message authentication codes

UNIT I INTRODUCTION **6**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS **6**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model.

UNIT III RANDOM ORACLES **6**

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-Random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF).

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION **6**

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES **6**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public

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Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Implement Feige-Fiat-Shamir identification protocol.
2. Implement GQ identification protocol.
3. Implement Schnorr identification protocol.
4. Implement Rabin one-time signature scheme.
5. Implement Merkle one-time signature scheme.
6. Implement Authentication trees and one-time signatures.
7. Implement GMR one-time signature scheme.

OUTCOMES:

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

- Interpret the basic principles of cryptography and general cryptanalysis
- Determine the concepts of symmetric encryption and authentication
- Identify the use of public key encryption, digital signatures, and key establishment
- Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions
- Express the use of Message Authentication Codes

TOTAL: 60 PERIODS

TEXT BOOK:

1. Hans Delfs and Helmut Knebl, "Introduction to Cryptography: Principles and Applications", Springer Verlag, 2010.
2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education (Low Priced Edition), 2003.

REFERENCES:

1. Shaffi Goldwasserand Mihir Bellare, "Lecture Notes on Cryptography", Available at http://citeseerx.ist.psu.edu/.
2. Oded Goldreich, "Foundations of Cryptography", CRC Press (Low Priced Edition Available), Part 1 and Part 2.
3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

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20IT804PE	ETHICAL HACKING	L T P C
	(COMMON TO AD, CSE AND IT)	3 0 0 3

OBJECTIVES:

The student should be made to:

- Learn basic of ethical hacking
- Impart knowledge on foot printing, social engineering, port scanning
- Study the concepts of Vulnerabilities in operating system
- Understand the concepts of hacking web servers, wireless networks
- Learn cryptography and security devices

UNIT I FUNDAMENTALS OF ETHICAL HACKING **9**

Introduction to Ethical Hacking - Legal and Illegal actions on NET - TCP/IP concepts: Overview of TCP/IP - IP Addressing and Number systems. Networks and Computer Attacks: Malware - Protecting against Malware attacks - Intruder attacks - Physical Security Addressing.

UNIT II FOOT PRINTING AND PORT SCANNING **9**

Using web tools for Foot Printing - Conducting competitive intelligence - Using DNS zone transfers - Social engineering, Port Scanning - Types of port scans - Scanning tools - Conducting Ping sweeps - Shell scripting.

UNIT III VULNERABILITIES IN OPERATING SYSTEM **9**

Microsoft OS: Tools to identify vulnerabilities on Microsoft systems - Microsoft OS vulnerabilities - Vulnerabilities in Microsoft services - Linux OS: Review of Linux Fundamentals - Linux OS vulnerabilities - Remote access attacks on Linux systems - Countermeasures against Linux remote attacks.

UNIT IV HACKING WEB SERVICES AND WIRELESS NETWORKS **9**

Web servers: Web applications, Web application vulnerabilities - Tools of web attackers and security testers - Wireless Networks: Wireless Technology - Wireless Network Standards - Authentication - War driving - Wireless Hacking.

UNIT V CRYPTOGRAPHY AND NETWORK PROTECTION **9**

Cryptography: Basics of Cryptography, Symmetric and Asymmetric algorithms - Public Key Infrastructure, Cryptography attacks - Protecting networks with security devices: Network security devices - Firewalls - Intrusion Detection Systems and Honeypots.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Understand the concepts of legal and illegal activities on Internet
- Acquire knowledge on foot printing tools and port scanning concepts
- Learn about tools to identify vulnerabilities on Microsoft systems and services
- Understand the concepts of hacking web server and learn about tools to protect web oriented services
- Ability to impart the knowledge of cryptography algorithms to provide security from attacks

TEXT BOOK:

1. Michael T. Simpson, "Ethical Hacking and Network defense", Course Technology, India Edition, 2010.

REFERENCES:

1. Ankit Fadia, "Ethical Hacking", Macmillan India Ltd, 2nd Edition, 2006.
2. Steven Defino, Barry Kaufman and Nick Valenteen, "Official Certified Ethical Hacker review guide", Cenage learning, 2012.
3. Ankit Fadia, "The Ethical Hacking Guide to Corporate Security", Macmillan Publishers, 2010.
4. James S Tiller, "The Ethical Hack: A Framework for Business value Penetration Testing", CRC Press, 2005.
5. Scambray and Joel, "Hacking Exposed Web Applications", Tata McGraw-Hill 2011.
6. https://www.lynda.com/Security-tutorials/...Ethical-Hacking/455716-2.html.

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20AD404PE	SECURE SOFTWARE SYSTEMS	L T P C
		2 0 2 3

OBJECTIVES:

The Student should be made to:

- Know the importance and need for software security
- Know about various attacks
- Learn about secure software design
- Understand risk management in secure software development
- Know the working of tools related to software security

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 6

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software - Memory-Based Attacks: Low-Level Attacks against Heap and Stack - Defense Against Memory-Based Attacks.

UNIT II SECURE SOFTWARE DESIGN 7

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection - Policy Specification Languages - Vulnerability Trends – Buffer Overflow - Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

UNIT III SECURITY RISK MANAGEMENT 5

Risk Management Life Cycle - Risk Profiling - Risk Exposure Factors - Risk Evaluation and Mitigation - Risk Assessment Techniques - Threat and Vulnerability Management.

UNIT IV SECURITY TESTING 8

History - Distributed ledger - Bitcoin protocols - Mining strategy and rewards - Ethereum - construction - Truffle - DAO - dApps - Smart Contract-Boot strapping - GHOST Vulnerability - Attacks - Sidechain - Namecoin.

UNIT V SECURE PROJECT MANAGEMENT 4

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice.

30 PERIODS

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PRACTICAL EXERCISES **30 PERIODS**

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.
5. Develop and test the secure test cases
6. Penetration test using kali Linux

TOTAL: 60 PERIODS

OUTCOMES:

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

- Identify various vulnerabilities related to memory attacks
- Apply security principles in software development
- Evaluate the extent of risks
- Involve selection of testing techniques related to software security in the testing phase of software development
- Use tools for securing software

TEXT BOOK:

1. Julia H. Allen, "Software Security Engineering", Pearson Education, 2008.
2. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First edition, Syngress Publishing, 2011.
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison-Wesley Professional, 2006.

REFERENCES:

1. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 20054.
2. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012.
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012.

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20AD405PE	BLOCKCHAIN	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Assess blockchain applications in a structured manner
- Impart knowledge in block chain techniques and able to present the concepts clearly and structured
- Get familiarity with future currencies and to create own crypto token
- Provide conceptual understanding of how blockchain technology can be used to innovate and improve business processes
- Integrate ideas from blockchain technology into their own projects

UNIT I BASIC CONCEPTS **9**

Introduction - Decentralized society - Disturbed Database, Byzantine General problem - Fault tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete - P2P network - Private key - Public key - Cryptography - Hash Function - Digital Signature - ECDSA - Memory Hard Algorithm - Zero Knowledge Proof.

UNIT II BLOCKCHAIN **9**

Introduction - Advantage over conventional distributed database - Network and protocols - Block chain network - Mining - Mechanism - Life Cycle of Block chain - Distributed consensus - Merkle Patricia Tree - Gas Limit -Transactions and Fee - Anonymity - Reward - Chain policy- Life of Block chain applications -Soft and Hard Fork - Private and Public blockchain.

UNIT III DISTRIBUTED CONSENSUS **9**

Nakamoto consensus - Proof of work - Proof of Stake - Proof of Burn - Difficulty level - Sybil Attack - Energy Utilization and alternate - Fabric model - SDKs - Components of Fabric Model - Architecture of Hyperledger fabric.

UNIT IV CRYPTOCURRENCY **9**

History - Distributed ledger - Bitcoin protocols - Mining strategy and rewards - Ethereum - construction - Truffle - DAO - dApps - Smart Contract-Boot strapping - GHOST Vulnerability - Attacks - Sidechain - Namecoin.

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UNIT V CRYPTOCURRENCY REGULATIONS 9

Stakeholders - Roots and Bitcoin - Legal Aspects - Crypto currency exchange - Black market and Global economy. Applications: IoT - Medical Record Management system - Domain Name Service and future of Blockchain - Business applications and assessing blockchain projects.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the various technologies and its business use
- Analyse the block chain applications in a structure manner
- Explain the modern concepts of block chain technology Systematically
- Handle the cryptocurrency
- Understand the modern currencies and its market usage

TEXT BOOK:

1. Daniel Drescher, "Blockchain basics A non-technical introduction in 25 steps", Apress, 2017.
2. Paul Vigna and Michael Casey J, "The Age of Cryptocurrency", 2015.

REFERENCES:

1. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.
2. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System", 2009.
3. Dr.Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow Paper, 2014.
4. Nicola Atzei, Massimo Bartoletti and Tiziana Cimoli, "A survey of attacks on Ethereum smart Contracts", Springer, 2017.

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20AD406PE CRYPTOGRAPHY PRINCIPLES AND NETWORK SECURITY

L T P C
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the fundamentals of cryptography
- Learn the key management techniques and authentication approaches
- Explore the network and transport layer security techniques
- Understand the application layer security standards
- Learn the real time security practices

UNIT I INTRODUCTION **9**

Basics of cryptography, conventional and public–key cryptography, hash functions, authentication, digital signatures, Security Attacks, Interruption, Interception, Modification and Fabrication.

UNIT II KEY MANAGEMENT AND AUTHENTICATION **9**

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509Certificates, Public-Key Infrastructure. User Authentication: Remote User - Authentication Principles, Remote User - Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III ACCESS CONTROL AND SECURITY **9**

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport LayerSecurity, HTTPS standard, Secure Shell (SSH) application.

UNIT IV APPLICATION LAYER SECURITY **9**

Electronic Mail Security: Pretty Good Privacy, S/MIME, E-Mail Security Services, DNS Security, Domain Keys Identified Mail. Wireless Network Security: Mobile Device Security, Network Security.

UNIT V SECURITY PRACTICES **9**

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Block chains, Cloud Security and IoT security.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Classify the encryption techniques
- Illustrate the key management technique and authentication
- Evaluate the security techniques applied to network and transport layer
- Discuss the application layer security standards
- Apply security practices for real time applications

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition, Pearson, 2014.

REFERENCES:

1. Speciner M, Perlman R, Kaufman C, "Network Security: Private Communications in a Public World", Prentice Hall, 2002.
2. Michael Gregg, "The Network Security Test Lab: A Step-By-Step Guide", Dreamtech Press, 2015.
3. Michael Stewart J, "Network Security, Firewalls and VPNs", Jones & Bartlett Learning, 2013.
4. Nicola Atzei, Massimo Bartoletti and Tiziana Cimoli, "A survey of attacks on Ethereum smart Contracts", Springer, 2017.

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20AD501PE	VIRTUAL REALITY	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand how the design of VR technology relates to human perception and cognition
- Discuss applications of VR to the conduct of scientific research, training, and industrial design
- Gain first-hand experience with using virtual environment technology, including 3D rendering software, tracking hardware, and input/output functions for capturing user data
- Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR
- Learn about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Virtual Reality and Virtual Environment: Introduction - Computer graphics - Real time computer graphics, Flight Simulation - Virtual environment requirement - benefits of virtual reality - Historical development of VR - Scientific Landmark.

UNIT II COMPUTER GRAPHICS AND GEOMETRIC MODELLING 9

Introduction - The Virtual world space - positioning the virtual observer - the perspective projection - human vision - stereo perspective projection - Color theory - Conversion From 2D to 3D, 3D space curves - 3D boundary representation - Simple 3D modeling - 3D clipping - Illumination models - Reflection models - Shading algorithms.

Geometrical Transformations: Introduction - Frames of reference - Modelling transformations - Instances - Picking - Flying- Scaling the VE - Collision detection

UNIT III VIRTUAL ENVIRONMENT 9

Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc.

Output: Visual /Auditory / Haptic Devices.

Generic VR system: Introduction-Virtual environment - Computer environment - VR technology - Model of interaction - VR Systems.

Animating the Virtual Environment: Introduction - The dynamics of numbers - Linear and Nonlinear interpolation - the animation of objects - linear and non - linear translation, shape & object in between - free from deformation, particle system.

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Physical Simulation: Introduction - Objects falling in gravitational field-Rotating wheels-Elastic collisions - projectiles-simple pendulum - springs - Flight dynamics of an aircraft.

UNIT IV AUGMENTED REALITY **9**

Taxonomy - technology and features of augmented reality - difference between AR and VR - Challenges with AR, AR systems and functionality - Augmented reality methods - visualization techniques for augmented reality - enhancing interactivity in AR environments - evaluating AR systems.

UNIT V DEVELOPMENT TOOLS AND FRAMEWORKS **9**

Human factors: Introduction - the eye, the ear, the somatic senses. Hardware: Introduction - sensor hardware - Head-coupled displays - Acoustic hardware - Integrated VR systems. Software: Introduction - Modeling virtual world - Physical simulation - VR Toolkits - Introduction to VRML.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR
- Understand geometric modeling and Virtual environment
- Relate and differentiate VR/AR technology
- Use various types of Hardware and software in virtual Reality systems
- Implement Virtual Reality applications

TEXT BOOK:

1. Grigore C Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley, 2016.
2. Alan B Craig, "Understanding Augmented Reality, Concepts and applications", Morgan Kaufmann, 2013.

REFERENCES:

1. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.
2. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.
3. Anand R, "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

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20IT701PE	COMPUTER GRAPHICS AND MULTIMEDIA COMMON TO AD, CSE AND IT	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn various primitives and drawing algorithms
- Understand the 2D and 3D geometric objects
- Understand various color models and graphics programming
- Study basics of multimedia and various files supporting multimedia
- Understand multimedia database structure

UNIT I GRAPHICS SYSTEMS AND 2D-PRIMITIVES **9**

Overview of Graphics System - Points and Lines - Line Drawing Algorithms - DDA, Bresenham - Circle and Ellipse Generating Algorithms - Line Attributes - Curve Attributes - Color and Grayscale Levels - Area fill attributes - Character attributes

UNIT II TWO-DIMENSIONAL TRANSFORMATIONS AND VIEWING **9**

Two-Dimensional Geometric Transformations - Types - Matrix Representation - Two Dimensional Viewing - Concatenation - Scaling - Rotation - 2D-Translation - Morphing - Mirroring-Clipping: Cohen Sutherland Line Clipping Algorithm, Sutherland-Hodgeman Polygon Clipping.

UNIT III THREE-DIMENSIONAL CONCEPTS AND GRAPHICS PRGRAMMING **9**

Three-Dimensional Object Representations - Polygon surfaces, Spline surfaces, Bezier curves - Octrees - Three-Dimensional Geometric and Modeling Transformations - Types - Three-Dimensional Viewing - Color models - Graphics programming using openGL.

UNIT IV MULTIMEDIA BASICS **9**

Introduction and definition - Multimedia software and Hardware - Media representation - Data and file format standards-TIFF,RIFF,MIDI,TWAIN File formats - Multimedia database - Multimedia data structures : KD trees - R trees, User Interface Design.

UNIT V MULTIMEDIA AUTHORING AND HYPERMEDIA MESSAGING **9**

2D authoring - 3D authoring - authoring using flash - Object Display/Playback Issues - Hypermedia Messaging: Mobile Messaging - Hypermedia Message Components - Hypermedia Linking and Embedding - Creating Hypermedia Messages - Components of Distributed Multimedia Systems.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Comprehend the basics of line ,circle and ellipse generating algorithms and different attributes and color levels
- Understand the 2D transformations and viewing the objects in various 2D Translation and clipping algorithms
- Understand the 3D geometric modeling and viewing the objects and Explicate the various color models and graphics programming
- Acquire the knowledge about the Multimedia Representation and data structures, File Format Standards along with digital audio and video
- Comprehend the different Hypermedia and Mobile Messaging, Recognize the authoring and Distributed concepts of the Multimedia Technology

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, "Computer Graphics C Version", 3rd Edition, Pearson Education, 2011.
2. Prabhat K Andleighand, Kiran Thakrar, "Multimedia Systems and Design", PHI, 2009

REFERENCES :

1. Foley, Vandam, Feiner, Huges, "Computer Graphics: Principles & Practice", Pearson Education, 2nd edition, 2003.
2. Judith Jeffcoate, "Multimedia in practice technology and Applications", PHI, 1998.
3. Amarendra N Sinha, Arun D Udai, "Computer Graphics", Tata McGraw Hill Education, 2014.
4. Tay Vaughan, "Multimedia: Making it Work", 9th edition, Tata McGraw Hill Education, 2014.

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20CS607PE **VIDEO CREATION AND EDITING**

(Common to AD, CSE and IT) **L T P C**

2 0 2 3

OBJECTIVES:

The Student should be made to:

- Introduce the broad perspective of linear and nonlinear editing concepts.
- Understand the concept of Storytelling styles.
- Be familiar with audio and video recording. To apply different media tools.
- Know about the working with basic & advanced editing and training techniques.
- Learn and understand the concepts of AVID XPRESS DV 4.

UNIT I FUNDAMENTALS **6**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression – risks associated with altering reality through editing.

UNIT II STORYTELLING **6**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO **6**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO **6**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4 **6**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

30 PERIODS

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LIST OF EXPERIMENTS **30 PERIODS**

1. Write a Movie Synopsis (Individual/Team Writing)
2. Present team stories in class.
3. Script/Storyboard Writing (Individual Assignment)
4. Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements
5. Production: Single camera production personnel & equipment, Documentary Production
6. Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching
7. Write Documentary & Animation Treatment
8. Post-production: Editing, Sound design, Finishing

TOTAL: 60 PERIODS

OUTCOMES:

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

- Compare the strengths and limitations of Nonlinear editing.
- Identify the infrastructure and significance of storytelling.
- Apply suitable methods for recording to CDs and VCDs.
- Address the core issues of advanced editing and training techniques.
- Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

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20AD502PE	DIGITAL MARKETING	L T P C
		3 0 0 3

OBJECTIVE:

The Student should be made to:

- Grasp the fundamental knowledge of Multimedia elements and systems
- Get familiar with Multimedia file formats and standards
- Learn the process of Authoring multimedia presentations
- Learn the techniques of animation in 2D and 3D and for the mobile UI
- Explore different popular applications of multimedia

UNIT I INTRODUCTION TO ONLINE MARKET **9**

Online Market space - Digital Marketing Strategy - Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION **9**

Search Engine optimization - Keyword Strategy - SEO Strategy - SEO success factors - On-Page Techniques - Off - Page Techniques. Search Engine Marketing - How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III E-MAIL MARKETING **9**

E-Mail Marketing - Types of E-Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile - Measuring and maximizing email campaign effectiveness. Mobile Marketing - Mobile Inventory/channels - Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns - Profiling and targeting.

UNIT IV SOCIAL MEDIA MARKETING **9**

Social Media Marketing - Social Media Channels - Leveraging Social media for brand conversations and buzz. Successful/benchmark Social media campaigns. Engagement Marketing - Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION **9**

Digital Transformation & Channel Attribution Analytics Ad words, Email, Mobile, Social Media, Web Analytics Changing your strategy based on analysis – Recent trends in Digital marketing.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Examine and explore the role and importance of digital marketing in today's rapidly changing business environment
- Focuses on how digital marketing can be utilized by organizations and howits effectiveness can be measured
- Know the key elements of a digital marketing strategy.
- Study how the effectiveness of a digital marketing campaign can be measured
- Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

TEXT BOOKS:

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", First Edition, Pearson Education, 2017.
2. Vandana Ahuja, "Digital Marketing", Oxford University Press, 2015.

REFERENCES:

1. Philip Kotler, "Marketing 4.0: Moving from Traditional to Digital", First Edition, Wiley, 2017.
2. Ryan D, "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation", Kogan Page Limited, 2014.
3. Barker, Barker, Bormann and Neher, "Social Media Marketing: A Strategic Approach", 2ESouth-Western, CengageLearning, 2017.

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20AD503PE MULTIMEDIA DATA COMPRESSION AND STORAGE **L T P C**

3 0 0 3

OBJECTIVE:

The Student should be made to:

- Understand the basics of compression techniques
- Understand the categories of compression for text, image and video
- Explore the modalities of text, image and video compression algorithms
- Know about basics of consistency of data availability in storage devices
- Understand the concepts of data streaming services

UNIT I INTRODUCTION TO MULTIMEDIA **9**

Introduction - Lossless and Lossy Compression - Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression - Applications.

UNIT II IMAGE COMPRESSION **9**

Lossless Image compression - JPEG - CALIC-JPEG LS-Prediction using conditional averages - Progressive Image Transmission - Lossless Image compression formats - Applications - Facsimile encoding.

UNIT III VIDEO COMPRESSION **9**

Introduction - Motion Compensation - Video Signal Representation - H.261 - MPEG-1- MPEG-2- H.263.

UNIT IV DATA PLACEMENT ON DISKS **11**

Statistical placement on Disks - Striping on Disks -Replication Placement on Disks - Constraint allocation on Disks - Tertiary storage Devices - Continuous Placement on Hierarchical storage system - Statistical placement on Hierarchical storage systems - Constraint allocation on Hierarchical storage system.

UNIT V DISK SCHEDULING METHODS **7**

Scheduling methods for disk requests - Feasibility conditions of concurrent streams - Scheduling methods for request streams.

TOTAL : 45 PERIODS

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OUTCOMES:

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

- Understand the basics of text, Image and Video compression
- Understand the various compression algorithms for multimedia content
- Explore the applications of various compression techniques
- Explore knowledge on multimedia storage on disks
- Understand scheduling methods for request streams

TEXT BOOKS:

1. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann Series in Multimedia Information and Systems, 5th Edition, 2018.
2. Philip K C Tse, "Multimedia Information Storage and Retrieval: Techniques and Technologies", 2008.

REFERENCES:

1. David Salomon, "A concise introduction to data compression", 2008.
2. Lenald Best, "Best`s Guide to Live Stream Video Broadcasting", BCB Live Teaching series, 2017.
3. Yun-Qing Shi, "Image And Video Compression For Multimedia Engineering Fundamentals Algorithms and Standards", Taylor& Francis,2019
4. Irina Bocharova, "Compression for Multimedia", Cambridge University Press; 1st Edition, 2009.

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28/8/23
ADS

20CS608PE **GAME DEVELOPMENT**
(Common to AD and CSE)

L T P C
2 0 2 3

OBJECTIVES:

The Student should be made to:

- Learn the basics of 2D and 3D graphics for game development.
- Know the stages of game development.
- Understand the basics of a game engine.
- Survey the gaming development environment and tool kits.
- Study and develop simple games using Pygame environment.

UNIT I 3D GRAPHICS FOR GAME DESIGN **6**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES **6**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN **6**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS **6**

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V GAME DEVELOPMENT USING PYGAME **6**

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

30 PERIODS

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EXPERIMENTS: **30 PERIODS**

1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game.
2. Character design, sprites, movement and character control
3. Level design: design of the world in the form of tiles along with interactive and collectible objects.
4. Design of interaction between the player and the world, optionally using the physics engine.
5. Developing a 2D interactive using Pygame
6. Developing a Puzzle game
7. Design of menus and user interaction in mobile platforms.
8. Developing a 3D Game using Unreal
9. Developing a Multiplayer game using unity

TOTAL: 60 PERIODS

OUTCOMES:

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

- Explain the concepts of 2D and 3d Graphics
- Design game design documents.
- Implementation of gaming engines.
- Survey gaming environments and frameworks.
- Implement a simple game in Pygame.

REFERENCES

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.
3. Paul Craven, "Python Arcade games", Apress Publishers,2016.
4. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.
5. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

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20AD504PE	VISUAL EFFECTS	L T P C
	(COMMON TO AD AND IT)	3 0 0 3

OBJECTIVE:

The Student should be made to:

- Get a basic idea on animation principles and techniques
- Get exposure to CGI, color and light elements of VFX
- Have a better understanding of basic special effects techniques
- Have a knowledge of state of the art vfx techniques
- Become familiar with popular compositing techniques

UNIT I ANIMATION BASICS 9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II CGI, COLOR, LIGHT 9

CGI - virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light - Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model.

UNIT III SPECIAL EFFECTS 9

Special Effects - props, scaled models, animatronics, pyrotechniques, Schufftan process, Particle effects - wind, rain, fog, fire.

UNIT IV VISUAL EFFECTS TECHNIQUES 9

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving - Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving.

UNIT V COMPOSITING 9

Compositing - chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Implement animation in 2D / 3D following the principles and techniques
- Use CGI, color and light elements in VFX applications
- Create special effects using any of the state of the art tools
- Apply popular visual effects techniques using advanced tools
- Use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

1. Chris Roda, "Real Time Visual Effects for the Technical Artist", CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, "Digital Visual Effects and Compositing, New Riders Press", 1st Edition, 2014.

REFERENCES:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, "The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual Storytelling, Routledge, 1st Edition, 2016.

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20AD601PE	ROBOTIC PROCESS AUTOMATION	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the basic concepts of Robotic Process Automation
- Expose to the key RPA design and development strategies and methodologies
- Learn the fundamental RPA logic and structure
- Explore the Exception Handling, Debugging and Logging operations in RPA
- Learn to deploy and maintain the software bot

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events.

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA.

TOTAL: 60 PERIODS

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OUTCOMES:

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

- Enunciate the key distinctions between RPA and existing automation techniques and platforms
- Use UI Path to design control flows and work flows for the target process
- Implement recording, web scraping and process mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes

TEXT BOOK:

1. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool –UiPath",Packt Publishing, 2018.
2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), "Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation", Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant", Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation RPA A Complete Guide", 2020.

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BoS (AD)

20CS807PE **NEURAL NETWORKS AND DEEP LEARNING**

(Common to AD and CSE) **L T P C**

2 0 2 3

OBJECTIVES:

The Student should be made to:

- Recognize the basics in deep neural networks
- Understand the basics of associative memory and unsupervised learning networks
- Apply CNN architectures of deep neural networks
- Analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- Apply autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION **6**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS **6**

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS **6**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV DEEP FEEDFORWARD NETWORKS **6**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

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UNIT V RECURRENT NEURAL NETWORKS **6**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

30 PERIODS

LAB EXPERIMENTS: **30 PERIODS**

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Improve the Deep learning model by fine tuning hyper parameters.
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre trained model on Keras for Transfer Learning
9. Perform Sentiment Analysis using RNN
10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
11. Image generation using GAN

Additional Experiments:

12. Train a Deep learning model to classify a given image using pre trained model.
13. Recommendation system from sales data using Deep Learning.
14. Implement Object Detection using CNN.
15. Implement any simple Reinforcement Algorithm for an NLP problem.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Apply Convolution Neural Network for image processing.
- Understand the basics of associative memory and unsupervised learning networks.
- Apply CNN and its variants for suitable applications.
- Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
- Apply autoencoders and generative models for suitable applications.

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TEXT BOOKSS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

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14/9/23 - ADS

20AD602PE	QUANTUM COMPUTING	L T P C
		2 0 2 3

OBJECTIVES:

The Student should be made to:

- Know the background of classical computing and quantum computing
- Learn the fundamental concepts behind quantum computation
- Study the details of quantum mechanics and its relation to Computer Science
- Gain knowledge about the basic hardware and mathematical models of quantum computation
- Learn the basics of quantum information and the theory behind it

UNIT I QUANTUM COMPUTING BASIC CONCEPTS **6**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives PostulatesofQuantum Mechanics - Quantum Bits - Representations of Qubits - Super positions.

UNIT II QUANTUM GATES AND CIRCUITS **5**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction.

UNIT III QUANTUM ALGORITHMS **7**

uantum parallelism - Deutsch's algorithm - The Deutsch -Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY **6**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY **6**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring AlgorithmQuantum Key Distribution - BB84 - Ekart 91.

30 PERIODS

PRACTICAL EXERCISES **30 PERIODS**

1. Single qubit gate simulation - Quantum Composer
2. Multiple qubit gate simulation - Quantum Composer
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.
4. IBM Qiskit Platform Introduction

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5. Implementation of Shor's Algorithms
6. Implementation of Grover's Algorithm
7. Implementation of Deutsch's Algorithm
8. Implementation of Deutsch-Jozsa's Algorithm
9. Integer factorization using Shor's Algorithm
10. QKD Simulation
11. Mini Project such as implementing an API for efficient search using Grover's Algorithms

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand the basics of quantum computing
- Understand the background of Quantum Mechanics
- Analyze the computation models
- Model the circuits using quantum computation environments and frameworks
- Understand the quantum operations such as noise and error correction

TEXT BOOK:

1. Parag K Lala, "Quantum Computing, A Beginners Introduction", First Edition, Mc Graw Hill Education (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information",Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, "Quantum Computing forEveryone", The MIT Press, Reprint Edition (8 September 2020).

REFERENCES:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge UniversityPress, 2007.

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BoS (AD)

20AD603PE	3D PRINTING AND DESIGN	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Discuss on basics of 3D printing
- Explain the principles of 3D printing technique
- Explain and illustrate inkjet technology
- Explain and illustrate laser technology
- Discuss the applications of 3D printing

UNIT I INTRODUCTION **9**

Introduction; Design considerations- Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation - Digital; Slicing; Software; File formats.

UNIT II PRINCIPLE **9**

Processes - Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.

UNIT III INKJET TECHNOLOGY **9**

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations - Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On - Demand; Material Formulation for jetting; Liquid based fabrication - Continous jet, Mulitjet; Powder based fabrication - Colourjet.

UNIT IV LASER TECHNOLOGY **9**

Light Sources - Types, Characteristics; Optics - Deflection, Modulation; Material feeding and flowLiquid, powder; Printing machines - Types, Working Principle, Build Platform, Print bedMovement, Support structures.

UNIT V INDUSTRIAL APPLICATIONS **9**

Product Models, manufacturing - Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Outline and examine the basic concepts of 3D printing technology
- Outline 3D printing workflow
- Explain and categorise the concepts and working principles of 3D printing using inkjet technique
- Explain and categorise the working principles of 3D printing using laser technique
- Explain various method for designing and modeling for industrial applications

TEXT BOOK:

1. Christopher Barnatt, "3D Printing: The Next Industrial Revolution", Create Space Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, "Inkjet Technology for Digital Fabrication", John Wiley & Sons, 2013.

REFERENCES:

1. Chua C K, Leong K F and Lim C S, "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
2. Ibrahim Zeid, "Mastering CAD CAM", Tata McGraw-Hill Publishing Co., 2007.
3. Joan Horvath, "Mastering 3D Printing", APress, 2014.

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20EC503OE	INTRODUCTION TO INTERNET OF THINGS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Assess the impact of IoT applications, architectures in real world
- Illustrate the infrastructure, protocols and integration requirements of deploying smart objects and connect them to network
- Study the prerequisites for implementing IoT based applications
- Absorb various IoT supporting technologies
- Infer the importance of setting-up smart environment, data Analytics and Security in IoT

UNIT I INTRODUCTION TO IoT **9**

Predecessors of IoT - Overview of Internet of Things: Emergence of IoT- IoT Networking Components - Addressing Strategies in IoT - IoT Sensing and Actuation: Sensors-Actuators IoT Processing Topologies and Types - IoT Connectivity Technologies.

UNIT II M2M to IoT **9**

Infrastructure and Service Discovery Protocols for IoT - Architecture - Protocols - Services – Discovery- Sensor and Actuator Networks - IoT device Integration; concepts, standards, Implementations - Protocols and Middleware.

UNIT III DEVELOPING IoT SOLUTIONS **9**

Interoperability in IoT - Introduction to Arduino Programming - Integration of Sensors and Actuators with Arduino - Introduction to Python programming and Raspberry Pi - Implementation of IoT with Raspberry Pi.

UNIT IV ASSOCIATE IoT TECHNOLOGIES **9**

Software Defined Networking (SDN) - SDN for IoT - Data Handling and Analytics - Cloud Computing: Fundamentals, service models, service management and security - Sensor-Clond - Fog Computing.

UNIT V IoT SMARTER ENVIRONMENTS AND DATA ANALYTICS **9**

Smart cities and smart homes - Connected Vehicles - Smart Grid - IoT Data Analytics platform - Introduction to Industrial IoT, IIC and Industry 4.0 - IIoT Analytics - Case studies: Analytics Agricultural IoT, Healthcare IoT and Activity IoT - Security Management in IoT – AAA Framework.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Interpret the impact and challenges posed by IoT networks leading to new architectural models
- Compare and contrast the deployment of smart objects and the technologies to connect them to network
- Appraise the basic requirements needed for designing real-time IoT based applications
- Develop novel IoT supporting technologies for real world entities
- Illustrate different sensor technologies for sensing different entities, data Analytics and Security in IoT

TEXT BBOKS:

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press, 2020).
2. Internet of Things: A Hands-on Approach, by Arshdeep Bahga and Vijay Madisetti (Universities Press, 2020).

REFERENCES:

1. Introduction to loT by Sudip Misra, Anandarup Mukherjee, Arijit Roy, Cambridge University Press, 2021.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles" 1st Edition, McGraw Hill Education, 2017.
3. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs63/

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29/8/23
AIDS

20IT802PE **PRINCIPLES OF ELECTRONIC COMMERCE**

(Common to AIDS and IT)

L T P C

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the Technology, infrastructure and Business in E-Commerce
- Know the systematic approach for building an E-Commerce site and mobile app by choosing software and hardware
- Understand the Security and Challenges in E-Commerce
- Learn business concepts with different marketing strategies
- Build an Own E-Commerce using Open Source Frameworks

UNIT I INTRODUCTION TO E-COMMERCE AND TECHNOLOGY INFRASTRUCTURE **9**

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

UNIT II BUILDING AN E-COMMERCE WEBSITE, MOBILE SITE AND APPS **9**

Systematic approach to build an E-Commerce: Planning, System Analysis, System Design, Building the system, Testing the system, Implementation and Maintenance, Optimize Web Performance – Choosing hardware and software – Other E-Commerce Site tools – Developing a Mobile Website and Mobile App.

UNIT III E-COMMERCE SECURITY AND PAYMENT SYSTEMS **9**

E-Commerce Security Environment – Security threats in E-Commerce – Technology Solutions: Encryption, Securing Channels of Communication, Protecting Networks, Protecting Servers and Clients – Management Policies, Business Procedure and Public Laws - Payment Systems.

UNIT IV BUSINESS CONCEPTS IN E-COMMERCE **9**

Digital Commerce Marketing and Advertising strategies and tools – Internet Marketing Technologies – Social Marketing – Mobile Marketing – Location based Marketing – Ethical, Social, Political Issues in E-Commerce.

UNIT V PROJECT CASE STUDY **9**

Case Study: Identify Key components, strategy, B2B, B2C Models of E-commerce Business model of any e-commerce website - Mini Project : Develop E-Commerce project in any one of Platforms like Woo-Commerce, Magento or Opencart.

TOTAL: 45 PERIODS

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BoS (IT)

OUTCOMES:

On Successful completion of the course, Students will be able to

- Explain the basic concepts and technologies used in the field of electronic commerce.
- Assess the different phases of systematic approach to build E-Commerce site and apps
- Discuss about the security issues and assess electronic payment systems.
- Select the marketing strategies, the ethical and social issues on E-Commerce.
- Analyze the impact of E-commerce on business models and strategy with case studies

TEXT BOOK:

1. Kenneth C.Laudon, Carol Guercio Traver, "E-Commerce: Business, Technology and Society", Pearson, 14th Edition, 2018.

REFERENCES

1. Kamalesh K. Balaji,Debjani Nag, "E-Commerce", Second Edition, McGraw Hill Education, 2015
2. Robbert Ravensbergen, "Building E-Commerce Solutions with Woo Commerce", PACKT, 2nd Edition.
3. http://docs.opencart.com/
4. http://devdocs.magento.com/
5. http://doc.prestashop.com/display/PS15/Developer+tutorials

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BoS (IT)

29/8/23
AD S

20IT702PE **SOCIAL NETWORK ANALYSIS**

(Common to CSE, AIDS and IT)

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3	0	0	3

OBJECTIVES:

The Student should be made to:

- Study about the basic network science notation and terminology.
- Learn the community analysis approaches.
- Acquire the knowledge about the user behavior in social networks.
- Learn the required data from real world social networks.
- Study about the right metrics to mine the web data.

UNIT I ESSENTIAL OF SOCIAL NETWORKS 9

Introduction to Social Networks – Graph Basics – Representation – Types of Graphs – Special Graphs – Network Measures: Centrality – Transitivity and Reciprocity – Balance and Status – Similarity. Network Models: Properties of Real World Networks.

UNIT II COMMUNITY ANALYSIS 9

Data Mining Essentials: Data Preprocessing – Data Mining Algorithms – Supervised Learning – Unsupervised Learning. Community Analysis: Community Detection – Evolution – Evaluation.

UNIT III RECOMMENDATION AND BEHAVIOR ANALYSIS 9

Recommendations in Social Media: Challenges – Classical Recommendation Algorithms – Recommendation using Social Context – Evaluating Recommendations. Behavior Analytics: Individual Behavior and Collective Behavior.

UNIT IV MINING SOCIAL WEB 9

Overview of Mining Twitter – Exploring Twitter API – Analyzing 140 Characters – Overview of Mining Facebook – Exploring Social Graph API – Analyzing Social Graph Connections

UNIT V MINING WEB PAGES 9

Overview of Mining Web Pages – Scraping, Parsing and Crawling the Web – Discovering the Semantics – Entity CentricAnalysis – Quality of Analytics for Processing Human Language Data.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain basic notation and terminology used in network science.
- Implement the approaches used for analyzing the data of social networks.
- Analyze the user behavior in social networks for the recent research in the area.
- Mine the required data from real world social networks using right app.
- Apply the right metrics to mine the data from web pages.

TEXT BOOKS:

1. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu, "Social Media Mining: An Introduction", 1st Edition, Cambridge University Press, 2014 (Unit-I, II, III).
2. Mathew A.Russel, "Mining the social web", 2nd Edition, O'Reilly Publications, 2013 (Unit-IV, V).

REFERENCES:

1. Ian Mc Culloh, Hellen Armstrong, Anthony Johnson, "Social Network Analysis with Applications", 1st Edition, Wiley Publications, 2013.
2. John Scott, "Social Network Analysis", 3rd Edition, SAGE Publications, 2013.
3. Maksim Tsvetovat and Alexander Kouznetsov, "Social Network Analysis for Startups", 1st Edition, O'Reilly Media, 2011.

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20CS509PE **OPTIMIZATION TECHNIQUES**

(Common to AD and CSE) **L T P C**

2 0 2 3

OBJECTIVES:

The Student should be made to:

- Formulate and solve linear programming problems (LPP).
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models

UNIT I LINEAR MODELS **6**

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 6

Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem.

UNIT III PROJECT SCHEDULING **6**

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

UNIT IV CLASSICAL OPTIMIZATION THEORY **6**

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

UNIT V QUEUING MODELS **6**

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

30 PERIODS

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16/10/23 - AM

PRACTICALS **30 PERIODS**

1. Solving simplex maximization problems using R programming.
2. Solving simplex minimization problems using R programming.
3. Solving mixed constraints problems – Big M & Two phase method using TORA.
4. Solving transportation problems using R.
5. Solving assignment problems using R.
6. Solving optimization problems using LINGO.
7. Studying Primal-Dual relationships in LP using TORA.
8. Solving LP problems using dual simplex method using TORA.
9. Sensitivity & post optimality analysis using LINGO.
10. Solving shortest route problems using optimization software
11. Solving Project Management problems using optimization software
12. Testing random numbers and random variates for their uniformity.
13. Testing random numbers and random variates for their independence
14. Solve single server queuing model using simulation software package.
15. Solve multi server queuing model using simulation software package.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Formulate and solve linear programming problems (LPP).
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models

TEXT BOOK:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

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20AD701PE	REINFORCEMENT LEARNING	L T P C
	(COMMON TO AD AND IT)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Gain knowledge in the basic concepts of Reinforcement learning.
- Understand concept of Policy Gradient Methods.
- Learn the concepts of Dynamic Programming and Monte Carlo Methods.
- Learn how to define RL tasks and the core principles behind the RL, including Eligibility traces.
- Understand the Hierarchical Reinforcement Learning.

UNIT I INTRODUCTION 9

Introduction to RL, RL Framework and applications, Introduction to Immediate RL, Bandit Optimalities, Value function based methods. Bandit Algorithms: UCB 1, Concentration Bounds, UCB 1 Theorem, PAC Bounds, Median Elimination, Thompson Sampling.

UNIT II POLICY GRADIENT METHODS 9

Introduction to Full RL, Policy Search – REINFORCE: Monte Carlo Policy Gradien, REINFORCE with Baseline, Contextual Bandits, Full RL Introduction, Returns, Value Functions and MDPs. MDP Modelling:Bellman Equation, Bellman Optimality Equation, Cauchy Sequence and Green's Equation, Banach Fixed Point Theorem, Convergence Proof.

UNIT III DYNAMIC PROGRAMMING AND MONTE CARLO METHODS 9

Lpi Convergence, Value Iteration, Policy Iteration. Dynamic Programming: Monte Carlo, Control in Monte Carlo, Off Policy MC, UCT, TD(0), TD(0) Control, Q-Learning, Afterstate.

UNIT IV ELIGIBILITY TRACES 9

Eligibility Traces, Backward View of Eligibility Traces, Eligibility Trace Control, Thompson Sampling Recap. Function Approximation: Linear Parameterization, State Aggregation Methods, Function Approximation and Eligibility Traces, LSTD and LSTDQ, LSPI and Fitted Q.DQN, Fitted Q & Policy Gradient Approaches: DQN and Fitted Q-Iteration, Policy Gradient Approach, Actor Critic and REINFORCE, REINFORCE (cont'd), Policy Gradient with Function Approximation.

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UNIT V HIERARCHICAL REINFORCEMENT LEARNING 9

Introduction to Hierarchical Reinforcement Learning, Types of Optimality, Semi Markov Decision Processes, Options, Learning with Options, Hierarchical Abstract Machines. Hierarchical RL: MAXQ, MAXQ Value Function Decomposition, Option Discovery. POMDPs: POMDP Introduction, Solving POMDP.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Implement in-code common algorithms following code standards and libraries used in RL
- Understand and work with approximate solutions and Policy Gradient Methods.
- Explore Dynamic Programming and Monte Carlo Methods.
- Workout RL tasks and the core principles behind the RL, including Eligibility traces.
- Analyze and work with Hierarchical Reinforcement Learning

TEXT BOOKS

1. Richard S Sutton and Andrew G Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell Stuart J and Peter Norvig, "Artificial intelligence: a modern approach", Pearson Education Limited, 2016.
3. Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002.

REFERENCES

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep learning", MIT press, 2017.
2. Marco Wiering, Martijnvan Otterlo (Ed), "Reinforcement Learning, State-of-the-Art", ALO, volume 12, Springer, 2012.
3. Keng WahLoon, Graesser Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data &Analytics Series, 2020.
4. Francois Chollet, "Deep Learning with Python", ManningPublications,2018.
5. Ragav Venkatesan, BaoxinLi, "Convolutional Neural Networks in Visual Computing", CRC Press,2018.

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20AD702PE	GAME THEORY	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets
- Formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications
- Draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues
- Introduce contemporary topics in the intersection of game theory, computer science, and economics
- Apply game theory in searching, auctioning and trading

UNIT I INTRODUCTION **10**

Introduction - Making rational choices: basics of Games - strategy - preferences - payoffs - Mathematical basics - Game - Rational Choice - Basic solution concepts-non- cooperative versus cooperative games - Basic computational issues - finding equilibria and learning in games -Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITHPERFECTINFORMATION **7**

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies - Nash equilibria - mixed strategy equilibrium - zero-sum games.

UNIT III GAMES WITHIMPERFECTINFORMATION **9**

Games with Imperfect Information - Bayesian Games - Motivational Examples - General Definitions - Information aspects - Illustrations - Extensive Games with Imperfect - Information - Strategies - Nash Equilibrium - Repeated Games - The Prisoner's Dilemma - Bargaining.

UNIT IV NON-COOPERATIVEGAMETHEORY **10**

Non-cooperative Game Theory - Self-interested agents - Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal - Form Games - Computing Nash equilibria of two-player, zero-sum games - Computing Nash equilibria of two-player, general-sum games - Identifying dominated strategies.

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UNIT V MECHANISMDESIGN 9

Aggregating Preferences - Social Choice - Formal Model - Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the notion of a strategic game and equilibria and identify the characteristics ofmain applications of these concepts
- Discuss the use of Nash Equilibrium for other problems
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation
- Identify some applications that need aspects of Bayesian Games
- Implement a typical Virtual Business scenario using Game theory

TEXT BOOKS:

1. Osborne M J, "An Introduction to Game Theory", Oxford University Press, 2012.
2. Machler M, Solan E, Zamir S, "Game Theory", Cambridge University Press, 2013.

REFERENCES:

1. Nisan N, Rough garden T, Tardos E, and Vazirani V V, "Algorithmic Game Theory", Cambridge University Press, 2007.
2. Dixit A and Skeath S, "Games of Strategy", Second Edition, W W Norton & Co Inc, 2004.
3. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.

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20AD703PE	ETHICS AND AI	L T P C
	(COMMON TO AD, CSE AND IT)	2 0 2 3

OBJECTIVES:

The Student should be made to:

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics – challenges and opportunities

UNIT I INTRODUCTION 6

Definition of morality and ethics in AI-Impact on society - Impact on human psychology - Impact on the legal system - Impact on the environment and the planet - Impact on trust.

UNIT II ETHICAL INITIATIVESIN AI 6

International ethical initiatives - Ethical harms and concerns - Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III AI STANDARDSANDREGULATION 6

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process –Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 6

Robot - Roboethics- Ethics and Morality - Moral Theories - Ethics in Science and Technology - Ethical Issues in an ICT Society - Harmonization of Principles - Ethics and Professional Responsibility - Roboethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGESANDOPPORTUNITIES 6

Challenges - Opportunities - ethical issues in artificial intelligence - Societal Issues Concerning the Application of Artificial Intelligence in Medicine - decision-making role in industries -National and International Strategies on AI.

30 PERIODS

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PRACTICAL EXERCISES **30 PERIODS**

1.Recent case study of ethical initiatives in healthcare, autonomous vehicles and defense

2. Exploratory data analysis on a 2 variable linear regression model

3. Experiment the regression model without a bias and with bias

4. Classification of a dataset from UCI repository using a perceptron with and without bias

5. Case study on ontology where ethics is at stake

6. Identification on optimization in AI affecting ethics

TOTAL: 60 PERIODS

OUTCOMES:

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

- Learn about morality and ethics in AI
- Understand the ethical harms and ethical initiatives in AI
- Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
- Learn about the societal issues in AI with National and International Strategies on AI
- Acquire the knowledge of real time application ethics, issues and its challenges

TEXT BOOKS:

1. Eleanor Bird Y, Jasmin Fox - Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkampand Alan Winfield, "The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
2. Patrick Lin, Keith Abney, George A Bekey, "Robot Ethics: The Ethical and Social Implications of Robotics",TheMITPress - January2014.

REFERENCES:

1. Paula Boddington,"Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms)", November2017.
2. Mark Coeckelbergh, "AI Ethics", The MIT Press Essential Knowledge series, April 2020.

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20AD704PE **AGILE METHODOLOGIES** **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software
- Provide a good understanding of software design and a set of software technologies and APIs
- Do a detailed examination and demonstration of Agile development and testing techniques
- Understand the benefits and pitfalls of working in an Agile team
- Understand Agile development and testing

UNIT I AGILE METHODOLOGY **9**

Theories for Agile Management - Agile Software Development - Traditional Model vs. Agile Model Classification of Agile Methods - Agile Manifesto and Principles - Agile Project Management - Agile Team Interactions - Ethics in Agile Teams - Agility in Design, Testing - Agile Documentations - Agile Drivers, Capabilities and Values.

UNIT II AGILE PROCESSES **9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development Extreme Programming: Method Overview - Life cycle - Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT **9**

Agile Information Systems - Agile Decision Making - Earl's Schools of KM - Institutional Knowledge Evolution Cycle - Development, Acquisition, Refinement, Distribution, Deployment, Leveraging - KM in Software Engineering - Managing Software Knowledge - Challenges of Migrating to Agile Methodologies - Agile Knowledge Sharing - Role of Story-Cards - Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING **9**

Impact of Agile Processes in RE-Current Agile Practices - Variance - Overview of RE Using Agile Managing Unstable Requirements - Requirements Elicitation - Agile Requirements Abstraction Model - Requirements Management in Agile Environment, Agile Requirements Prioritization - Agile Requirements Modeling and Generation - Concurrency in Agile Requirements Generation.

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UNIT V AGILITY AND QUALITY ASSURANCE **9**

Agile Product Development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile Approach to Quality Assurance - Test Driven Development - Agile Approach in Global Software Development.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Perform iterative software development processes: how to plan them, how to execute them
- Point out the impact of social aspects on software development success
- Develop techniques and tools for improving team collaboration and software quality
- Perform Software process improvement as an ongoing task for development teams
- Show how agile approaches can be scaled up to the enterprise level

TEXT BOOKS:

1. David J Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

REFERENCES:

1. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Addison-Wesley, 2004.
2. Kevin C Desouza, "Agile Information Systems: Conceptualization, Construction and Management", Butter worth-Heinemann, 2007.

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ADS

20CS704PE	SOFT COMPUTING	L T P C
	(Common to AD, CSE, ECE and IT)	3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the various soft computing frames works.
- Be familiar with design of various neural networks.
- Be exposed to fuzzy logic.
- Learn genetic programming.
- Be exposed to hybrid systems.

UNIT I BASICS OF SOFT COMPUTING 9

Soft computing: Introduction - Soft Computing Vs. Hard Computing - Types of soft computing techniques - Applications of Soft Computing. Artificial Neural Network: Introduction - Characteristics - Learning Methods - Taxonomy - Evolution of Neural Networks - Basic Models - Important Technologies - Applications of Neural Network.

UNIT II NEURAL NETWORKS 9

Supervised Learning Network: Perceptron Networks - Adaptive linear Neuron - Multiple Adaptive linear Neuron - BPN - RBF - Associative Memory Network: Auto Associative Memory Network - Hetero Associative Memory Network - Bidirectional Associative Memory - Hopfield Networks - Iterative Auto Associative Memory Network- Unsupervised Learning Networks: Kohonen self-Organizing Feature Maps, LVQ - CP Networks, ART Network.

UNIT III FUZZY LOGIC 9

Fuzzy Logic: Fuzzy set theory - Fuzzy set versus crisp set - Crisp Relation and Fuzzy Relations - Fuzzy systems: crisp logic - Fuzzy Logic - Introduction and Features of Membership Functions. Fuzzy rule base system: Fuzzy propositions - formation - Decomposition and Aggregation of Fuzzy Rules - Fuzzy Reasoning - Fuzzy Inference Systems - Fuzzy Decision Making and Applications of Fuzzy Logic - Defuzzification.

UNIT IV GENETIC ALGORITHM 9

Introduction to Genetic Algorithms (GA) - Representation - Operators in GA - Fitness function - Population - Building block hypothesis and schema theorem - Genetic Algorithms Operators - Methods of Selection - Crossover and Mutation - Simple GA(SGA) - Other types of GA - Generation gap - Steady state GA - Applications of GA.

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UNIT V HYBRID SOFT COMPUTING TECHNIQUES 9

Neuro fuzzy Hybrid Systems – Fuzzy BP Architecture - Genetic Neuro Hybrid Systems - Genetic fuzzy Hybrid and fuzzy Genetic Hybrid Systems - Simplified fuzzy ARTMAP - Applications: Optimization of Traveling Salesman Problem using Genetic Algorithm Approach - Soft Computing Based Hybrid fuzzy Controllers.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Identify soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

TEXT BOOK:

1. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES:

1. Jang J S R, Sun C T and Mizutani E, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
3. RajasekaranS and VijayalakshmiPai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
4. Simon Haykin, "Neural Networks Comprehensive Foundation" Pearson Education, Second Edition, 2005.
5. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
6. http://nptel.ac.in/courses/106106046/41

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20AD705PE	GENETIC ALGORITHMS	L T P C
		3 0 0 3

OBJECTIVES:

The Student should be made to:

- Familiarize with Mathematical foundations for Genetic algorithm, operators
- Study the Applications of Genetic Algorithms
- Understand and analyze the Genetic based machine learning and its applications
- Provide a broad introduction to the field of Genetic Algorithms
- Apply Evolutionary Computation techniques to solve problems in their fields of study

UNIT I META HEURISTIC ALRORITHM IN SCIENTIFIC MODELS 9

A brief history of evolutionary computation - Elements of genetic algorithms - A simple genetic algorithm - Applications of genetic algorithms - Evolving computer programs - Data analysis and prediction - Evolving neural networks - Modeling interaction between learning and evolution - Modeling sexual selection - Measuring evolutionary activity.

UNIT II THEORETICAL FOUNDATION OF GENETIC ALGORITHM 9

Schemas and Two - Armed and k-armed problem - royal roads - exact mathematical models of simple genetic algorithms - Statistical - Mechanics Approaches.

UNIT III COMPUTER IMPLEMENTATION OF GENETIC ALGORITHM 9

Data structures - Reproduction-Crossover and mutation - Mapping objective functions to fitness form- fitness scaling - Coding - Multiparameter - Mapped-fixed point coding - Discretization and constraints.

UNIT IV APPLICATIONS OF GENETIC ALGORITHMS9

The Risk of Genetic Algorithms - De Jong and Function Optimization - Improvement in Basic Techniques - Current Application of Genetic Algorithms.

UNIT V ADVANCED OPERATORS AND TECHNIQUES IN GENETIC SEARCH9

Dominance - Duplicity And Abeyance- Inversion and other Reordering Operators - other Micro Operators - Niche and Speciation - Multi Objective Optimization - Knowledge Based Techniques - Genetic Algorithms and Parallel Processors.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Explain the principles underlying Evolutionary Computation in general and Genetic algorithms in particular
- Apply Evolutionary Computation Methods to find solutions to complex problems
- Analyze and experiment with parameter choices in the use of Evolutionary Computation Summarize current research in Genetic Algorithms and Evolutionary Computing
- Write a program or use a package to implement an evolutionary algorithm
- Conduct evolutionary optimization experiments and properly report and discuss the results

TEXTBOOKS:

1. David E Goldberg, "Genetic algorithms in search, optimization and Machine Learning", by Pearson Education, 1998.

REFERENCES:

1. Melanle Mitchell, "An introduction to genetic algorithms", by PHI, 1998.
2. Michael D Vose, "The simple genetic algorithm foundations and theory", by PHI, 2004.

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20BM501OE BASICS OF BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:
The student should be able to:

- Gain knowledge about various physiological parameters of both electrical and non-electrical
- Know the importance of pH, pO_2, pCO_2 levels in human
- 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 I 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 diagrammatic 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

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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

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 Edition, 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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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

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TEXT BOOKS:

1. Lodish, Harvey etal., " Molecular Cell Biology", 5th Edition, W H Freeman, 2005.
2. Cooper G M and Hansman R E, "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 and Roger J B, "Cancer Biology" Addison Wesley Longman, 1996.

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20CE501PE	INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
	(Common to AD, AGE, BME, ECE, EEE, CSE, IT, Mech)	3	0	0	3

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
- Demonstratebiological waste water treatment process
- Acquire knowledge on treatment ofsludge 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:

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

- Gain knowledge on undesirable waste water characteristics
- Understand various methods dealt with treatment of waste water
- Illustrate 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,"Industrial Water Pollution Control", 3rdEdition, 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. Rao M N&Dutta A K, "Wastewater Treatment", Oxford - IBH Publication, 1995.
2. Freeman H M, "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
	(Common to AD, AGE, BME, ECE, EEE, CSE, IT, Mech)	3	0	0	3

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", McGraw Hill, New York, 1995.

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.
4. Anjaneyulu Y, "Air Pollution and Control Technologies", Allied Publishers Pvt.Ltd., India, 2002.

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20CE602OE SMART MATERIALS AND SMART STRUCTURES L T P C

3 0 0 3

OBJECTIVES:

The student should be made 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.

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

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BoS (AD)

OUTCOMES:

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

- Aware various principles of smart and hybrid structures
- Analyze specifications 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", Artech House, Boston London, 2004.

REFERENCE BOOKS:

1. Srinath L S, "Experimental Stress Analysis", Tata McGraw Hill, 1998.
2. Dally J W and Riley W F, "Experimental Stress Analysis", Tata McGraw Hill, 1998.

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20EC501OE	SENSORS AND TRANSDUCERS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the concepts of measurement and characteristics of transducers
- Learn the various sensors used to measure various physical parameters
- Apply the concept of sensors for force, magnetic and heading sensor
- Explain the concept of optical, pressure and temperature sensors
- Distinguish the DAQ systems with different sensors for real time applications

UNIT I INTRODUCTION 9

Basics of Measurement - Classification of errors - Error analysis - Static and dynamic characteristics of transducers - Performance measures of sensors - Classification of sensors - Sensor calibration techniques - Sensor Output Signal Types - First order and Second order Transducer systems.

UNIT II MOTION AND RANGING SENSORS 9

Motion Sensors - Potentiometers, Resolver, Encoders - Optical, Magnetic, Inductive, Capacitive, LVDT - RVDT - Synchro - Microsyn, Accelerometer - GPS, Bluetooth, Range Sensors - Light Detection and Ranging (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gauge, Load Cell and Magnetic Sensors - types and principle-Magnetoresistive - Hall Effect - Eddy Current sensor - Heading Sensors: Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE, TEMPERATURE AND SMART SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR - Fiber optic sensors - Pressure: Diaphragm, Bellows, Piezoelectric - Temperature - Thermistor, RTD, Thermocouple. Acoustic Sensors: Flow and level measurement, Radiation Sensors - Smart Sensors - MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification - Filtering - Sample and Hold circuits - Data Acquisition: Single channel and multi channel data acquisition - Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Expertise in various calibration techniques and signal types for transducers
- Understand the basic principles of various motion and ranging sensors
- Analyze the various sensor in force, heading and temperature applications
- Apply the various sensor applications in optical, pressure, temperature and smart sensor
- Implement the DAQ systems with different sensors for real time applications

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems-Applications and Design", Tata McGraw Hill, 2009.
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", Dhanpat Rai and Co, New Delhi, 12th Edition, 2013.

REFERENCES:

1. Patranabis D, "Sensors and Transducers", PHI, New Delhi, 2nd Edition, 2010.
2. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999
3. Richard Zurawski, "Industrial Communication Technology Handbook", CRC Press, 2nd Edition, 2015.
4. Dr Sengolrajan T and Sampath A, "Sensors and Transducers", Sri Krishna Hitech Publishing Company Pvt. Ltd, 1st Edition, 2019.
5. Dr Vijayachitra S, "Transducer Engineering", PHI Learning Pvt. Ltd, 1st Edition 2016.

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AD, CSE, IT, ME, BME, [illegible], ECE

20EE501OE NON-CONVENTIONAL ENERGY RESOURCES

L T P C
3 0 0 3

OBJECTIVES:

The students should be made to,

- Acquire knowledge on various sources of non-conventional energy
- Learn the fundamental concepts about solar energy systems and devices
- Design wind turbine system and know about facts of wind energy in electricity generation
- Understand the geothermal and biomass energy system
- Discuss other energy sources

UNIT I INTRODUCTION **9**

Electric energy from conventional sources - Energy reserves - Power scenario in India - Types of Renewable energy sources - New technologies of energy resources - Impact on renewable generation on environment - Biochemical cycles - Global warming potential - Forest resources and water management in India - Biodiversity.

UNIT II SOLAR ENERGY **9**

Solar radiation - Geometry, Estimation and Measurements - Solar thermal energy storage - Solar thermal electric power plant - Solar ponds - Solar air heaters - Solar cookers - Solar air conditioning and refrigerators - Solar greenhouse - Solar photovoltaic system and its standards - Application of PV system - PV hybrid system.

UNIT III WIND ENERGY **9**

Classification of wind turbines and rotors - Terms used in wind energy - Wind energy characteristics - Land for wind energy - Design of wind turbine rotor - Modes of wind power generation - Estimation of wind energy potential - Wind resource assessment in India - Grid system and properties.

UNIT IV GEOTHERMAL AND BIOMASS ENERGY **9**

Structure of Earth's interior - Geothermal resources and its power generation - Biomass resources - Biomass conversion technology - Biochemical conversion - Biomass gasification - Biogas and its plant - Power generation from liquid waste - Biomass cogeneration - Biodiesel - Biofuel petrol.

UNIT V OTHER ENERGY SOURCES **9**

Tidal energy: Tidal characteristics - Tidal energy and its potential estimation - Development of tidal power scheme - important component of tidal power plant - Tidal power development in India - Wave Energy: Factors affecting the wave energy - Mathematical analysis of wave energy - Principle of wave energy plant - Wave energy conversion machines - Ocean Thermal Energy Conversion (OTEC): Working Principle - Closed cycle OTEC system - Thermoelectric OTEC - Application and global development.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Demonstrate the various causes of renewable energy sources with environmental aspect
- Illustrate the concept of solar energy technology
- Analyze the techniques used in wind energy sources
- Know the classification and operation of geothermal and biomass sources
- Enumerate the details of other energy sources

TEXT BOOK:

1. Kothari P, Singal K C and Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", 2nd Edition, PHI Pvt. Ltd., New Delhi, 2011.

REFERENCES:

1. Godfrey Boyle, "Renewable Energy – Power for a Sustainable Future", Oxford University Press, U.K, 1996.
2. Twidell J W and Weir A, "Renewable Energy Sources", EFN Spon Ltd., UK, 1986.
3. Tiwari G N, "Solar Energy – Fundamentals Design", Modelling and applications, Narosa Publishing House, New Delhi, 2002.
4. ShobhNath Singh, "Non–conventional Energy Resources" Pearson Education, 2015.
5. Scott Grinnell, "Renewable Energy and Sustainable Design", CENGAGE Learning, USA, 2016.

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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 equipment's 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

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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 equipments
- Analyze the theory and operation of PLC programming instructions
- Impart the knowledge of SCADA system
- Develop various industrial automation applications

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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AD, Mech, CSE, IT

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

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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

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, 1990.
4. Barney L Capehart, Wayne C, Turner and William J Kenned, "Guide to Energy Mangement", Fifth Edition, The Fairmont Press, Inc., 2006.

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AD, CSE, IT, EE, [illegible], BME, ECE

20ME601OE	PRODUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

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, 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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OUTCOMES:

On successful completion of the course, students should 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 components
- 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 WAJ. "Workshop Technology".
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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AD, CSE, IT, CE, EEE, BME, AGE, EEE

20ME602OE **BASICS OF AUTOMOTIVE COMPONENTS** **L T P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the various engine components of automobiles
- Illustrate the different types of transmission system used in automobiles
- Study the construction of various engine auxiliary systems
- Learn about working principles of steering, suspension and braking systems
- Describe about the fundamentals of alternative energy sources and Ignition

UNIT I ENGINE COMPONENTS **9**

Overview - Engine Components - Engine block, Crank shaft, Connecting rod, Cylinder Liners, Piston, Piston rings, Cylinder head - Camshaft, Valve, Rocker Arm, Spark Plug, Injector, Carburetor, Fuel pump.

UNIT II TRANSMISSION COMPONENTS **9**

Flywheel - Clutch - Friction plate, Clutch housing, Pressure plate. Gearbox - Propeller shaft - Differential - Conventional Differential, Rear axle.

UNIT III BODY COMPONENTS **9**

Types of automobiles - Vehicle construction and different layouts, chassis, Frame and body - Vehicle aerodynamics.

UNIT IV STEERING, SUSPENSION SYSTEMS AND BRAKES **9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS).

UNIT V ALTERNATIVE FUELS AND IGNITION SYSTEMS **9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles. Ignition System - Battery and Magneto Ignition System - Principles of Combustion and detonation CI Engines. Lubrication and Cooling systems.

TOTAL: 45 PERIODS

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OUTCOMES:

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

- Recognize the various parts of the automobile and their functions
- Distinguish the working of different types of power transmission systems like clutch, gears
- Demonstrate the Vehicle construction and Vehicle aerodynamics
- Explain about the Steering, Brakes and Suspension systems
- Predict possible alternate sources of energy and ignition system for automotive Engines

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering", Vol. 1 and 2, Seventh Edition, Standard Publishers, New Delhi, 14th Edition 2017.
2. Ganesan V, "Internal Combustion Engines", Tata McGraw-Hill, 4th Edition, 2018.

REFERENCES:

1. Joseph Heitner, "Automotive Mechanics", East-West Press, Second Edition, 1999.
2. Jain K K and Asthana R B, "Automobile Engineering", Tata McGraw Hill Publishers, New Delhi, 2002.
3. Martin W, Stockel and Martin T Stockle, "Automotive Mechanics Fundamentals", The Good Heart-Will Cox Company Inc, USA, 1978.

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20BM701OE **BIOINFORMATICS** **L T P C**

(COMMON TO AD, AGE, CSE, IT, MECH, ECE, EEE, CIVIL) **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 pair wise 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.

OUTCOMES: **TOTAL: 45 PERIODS**

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

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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.

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**

(COMMON TO AD, AGE, CSE, IT, MECH, ECE, EEE, CIVIL) **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 behaviors toward weight control - Food and pharmaceutical grade - Toxicities, Deficiencies, Factors affecting bio availability, Stability under food processing conditions.

TOTAL: 45 PERIODS

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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 and Schieberle P, "Food Chemistry", Third Revised Edition, Springer, Verlag, 2004.

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20CE701OE ENVIRONMENTAL IMPACT ASSESSMENT **L T P C**

(COMMON TO AD, AGE, CSE, IT, MECH, ECE, EEE, BME) **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 LEGISLATION AND 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**

(COMMON TO AD, AGE, CSE, IT, MECH, ECE, EEE, BME) **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", Good heart Wilcox 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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20EC701OE **CONSUMER ELECTRONICS** **L T P C**

(COMMON TO AD, AGE, CSE, IT, MECH, BME, EEE, CIVIL) **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.

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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

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 in TV
- Familiarize in home/office appliances

TEXT BOOKS:

1. Bali S P, "Consumer 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.

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20EC702OE **RFID AND FLEXIBLE SENSORS** L T P C

(COMMON TO AD, AGE, CSE, IT, MECH, BME, EEE, CIVIL) 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 - simulation and anti - collision procedures tag 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.

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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

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.

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20EE701OE **ENERGY STORAGE SYSTEMS** **L T P C**

(COMMON TO AD, AGE CSE, IT, MECH, ECE, BME, CIVIL) **3 0 0 3**

OBJECTIVES:

The students should be made to:

- Understand the basic concepts of energy storage devices
- Learn the performance of various types of batteries
- Explain the operation of fuel cells and ultra capacitors
- Analyse the application of energy storage devices
- Know the thermal and mechanical energy storage systems

UNIT I ENERGY STORAGE TECHNOLOGIES **9**

Introduction - Need of energy storage - Battery - Components of cells and batteries - Classification - Operation of a cell - Theoretical cell voltage, capacity and energy - Electrochemical principles and reactions: Cell polarization - Electrical double - layer capacity and ionic adsorption - Mass transport to the electrode surface - Factors affecting battery performance - Standards.

UNIT II PRIMARY AND SECONDARY BATTERIES **9**

Battery parameters and specification - Performance, charging and discharging - Storage density, energy density, classical and modern batteries: Zinc - chloride, Nickel cadmium, Lead acid, Nickel hydride and Lithium battery - Principle and working.

UNIT III ADVANCED BATTERIES FOR EV APPLICATIONS **9**

Ultra capacitors: Features - Basic principles of ultra capacitors - Performance of ultra capacitors - Mathematical model. Fuel cells: Operating principles - Characteristics - Polarization loss - Fuel cells technologies - Comparison of fuel cells, hybridization of energy storage systems.

UNIT IV APPLICATIONS OF BATTERIES **9**

Storage of solar - Greenhouse heating - Power plant application - Batteries in space - Storage in electric supply networks - Automotive application in hybrid and electric vehicles - Role of ultra capacitors in EVs.

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UNIT V THERMAL AND MECHANICAL ENERGY STORAGE **9**

Thermal energy storage - Energy storage in hydrogen - Energy storage in flywheels - Pumped hydro storage - Elastic energy storage - Applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe the working of energy storage devices
- Differentiate the characteristics of various primary and secondary batteries
- Compare the operation of ultra capacitors and fuel cells
- Summarize the applications of batteries
- Explain the different energy storage techniques

TEXT BOOK:

1. Robert A Huggins, "Energy Storage - Fundamentals, Materials and Applications", 2nd Edition, Springer, 2016.

REFERENCES:

1. Ibrahim Dincer and Marc A Rosen, "Thermal Energy Storage: Systems and Applications", 2nd Edition, John Wiley and Sons, 2011.
2. Ru-shiLiuLei Zhang, Xueliang Sun, Hansan Liu andJiujun Zhang, "Electrochemical Technologies for Energy Storage and Conversion", Wiley publications, 2012.
3. Ali Emadi, Mehrdad Ehsani and John M Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010.
4. Tetsuya Osaka and MadhavDatta, "Energy Storage Systems in Electronics", Gordon and Breach Science Publishers, 2000.
5. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd Edition, CRC Press, Taylor and Francis Group, 2011.

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20EE702OE	ELECTRICAL SAFETY ENGINEERING	L T P C
	(COMMON TO AD, AGE, CSE, IT, MECH, ECE, BME, CIVIL)	3 0 0 3

OBJECTIVES:

The students should be made to:

- Know the concepts of safety engineering
- Learn the various electrical hazards and safety equipment
- Analyze the grounding and bonding techniques
- Compare the safety methods for various electrical equipment
- Understand the various standards for proper maintenance of electrical equipment

UNIT I CONCEPTS IN SAFETY 9

Introduction - Electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference - Working principles of electrical equipment - Indian electricity act and rules - Statutory requirements from electrical inspectorate - International standards on electrical safety - First aid - Cardio Pulmonary Resuscitation (CPR).

UNIT II ELECTRICAL HAZARDS AND SAFETY EQUIPMENTS 9

Primary and Secondary hazards - Arc, blast and shocks - Causes and effects - Safety equipment - Person Protection Equipment(PPE), Head and eye protection, flash and thermal protection. Rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags and locking devices - Voltage measuring instruments - Proximity and contact testers - Safety electrical one line diagram - Electrician's safety kit.

UNIT III GROUNDING AND BONDING TECHNIQUES 9

General requirements for grounding and bonding - Definitions - Grounding of electrical equipment - Bonding of electrically conducting materials and other equipment - Connection of grounding and bonding equipment - System grounding - Purpose of system grounding - Grounding electrode system - Grounding conductor connection to electrodes - Use of grounded circuit conductor for grounding equipment - Grounding of low voltage and high voltage systems.

UNIT IV SAFETY METHODS OF EQUIPMENT 9

The six step safety methods - Pre job briefings - Hot-Work decision tree - Safe switching of power system - Lockout - Tag out - Flash hazard calculation and approach distances - Calculating the required level of arc protection - Safety equipment - Procedure for low, medium and high voltage systems - The one minute safety audit.

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UNIT V SAFETY SCHEDULE AND MAINTENANCE **9**

Safety related case for electrical maintenance - Reliability Centered Maintenance (RCM) - Eight step maintenance programme - Frequency of maintenance - Maintenance requirement for specific equipment and location - Regulatory bodies - National electrical safety code - Standard for electrical safety in work place - Occupational safety and health administration standards.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the basic concepts related to safety
- Describe electrical hazards and safety equipment
- Identify various grounding and bonding techniques
- Select appropriate safety method for low, medium and high voltage equipment
- Conduct proper maintenance of electrical equipment according to standards

TEXT BOOK:

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis K Neitzel and Al Winfield, "Electrical Safety Handbook", 4th Edition, McGraw-Hill Education, 2012.

REFERENCES:

1. Mohamed El Sharkawi, "Electric Safety-Practice and Standards", CRC Press, 2014.
2. Maxwell Adams J, "Electrical Safety-A guide to the Causes and Prevention of Electric Hazards", 1st Edition, The Institution of Engineering and Technology, 1994.
3. Ray A Jones, Ray Jones and Jane G Jones, "Electrical Safety in the Workplace", 1st Edition, Jones and Bartlett Learning, 2000.
4. Fortham Cooper W, "Electrical Safety Engineering", 1st Edition, Butterworth and Company, London, 1998.
5. Kimberly Keller, "Electrical Safety Code Manual", Elsevier, 2010.

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20ME701OE	BASICS OF HYDRAULIC AND PNEUMATIC SYSTEMS	L	T	P	C
		3	0	0	3

(COMMON TO AD, AGE, CSE, IT, BME, ECE, EEE, CIVIL)

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 and 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.

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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
- 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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20ME702OE	ALTERNATIVE ENERGY FUELS	L	T	P	C
	(COMMON TO AD, AGE, CSE, IT, BME, ECE, EEE, CIVIL)	3	0	0	3

OBJECTIVES:

The Students should be made to:

- Familiarize with various sources of energies available in universe
- Study the methods of liquid fuel extraction
- Know the concepts of fuel cells and types
- Learn the properties and preparation techniques of biodiesel
- Understand the production techniques of nuclear energy

UNIT I INTRODUCTION TO ENERGY 9

World energy consumption - petroleum - natural gas - coal - nuclear energy - geo thermal energy - renewable energy - solar, wind, tidal, biomass and hydropower.

UNIT II LIQUID FUELS 9

Introduction to coal pyrolysis - char oil energy development process - TOSCOAL process - Lurgi - Ruhr gas process - occidental flash pyrolysis process - clean coke process - coalcon process.

UNIT III FUEL CELLS 9

Introduction - basic concepts - design characteristics - operation - thermal efficiency - cell voltage - fuel cell system - general description - fuel cell classifications - low temperature fuel cells - proton exchange membrane fuel cells and alkaline fuel cells - high temperature fuel cells - molten carbonate fuel cells and solid oxide fuel cells.

UNIT IV BIODIESEL 9

Introduction - transesterification process for biodiesel manufacture - pretreatment of oil - transesterification reaction in a biodiesel reactor - product and by-product separation - purification - properties of biodiesel - cetane number - calorific value - general physical properties of biodiesel - cold flow properties - material compatibility.

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UNIT V NUCLEAR ENERGY 9

Nuclear fission and nuclear reactor physics - electricity generation from nuclear reactors - nuclear fuel cycle - types of reactors - advanced reactors and concepts - hydrogen production - nuclear waste disposal - nuclear fusion.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the various sources of energy
- Demonstrate liquid fuel extraction through pyrolysis processes
- Understand the importance and design considerations of fuel cells
- Describe the process involved in the extraction of biodiesel
- Analyse the utilization and waste disposal of nuclear energy

TEXT BOOKS:

1. Sunggyu Lee, James G Speight, "Handbook of Alternative Fuel Technologies", CRC Press, Taylor & Francis Group, 2014.
2. Arumugam S Ramadhas, "Alternative Fuels for Transportation", Taylor & Francis, 2016.

REFERENCES:

1. Donald L Klass, "Biomass for Renewable Energy, Fuels and Chemicals", Elsevier-Academic Press, 1st Edition.
2. Sunggyu Lee, "Alternative Fuels", CRC Press, Taylor & Francis, 1st Edition.
3. Suresh M, Rajkumar S, Lakshminarayanan A K, "Alternative Energy Sources, Materials and Technologies", Trans Tech Publications Limited, 2015.

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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

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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

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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

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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

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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.

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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

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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

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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.

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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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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 (COMMON TO ALL BRANCHES)	L	T	P	C
		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

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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

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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.

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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

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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.

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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

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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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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.

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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

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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.

CHAIRMAN
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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BOS/ECE

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)

CHAIRMAN
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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BOS/ECE

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.

CHAIRMAN
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)

CHAIRMAN
BOS/ECE

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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BOS/ECE

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.

CHAIRMAN
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

CHAIRMAN
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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BoS (AD)

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.

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BoS (AD)

20M404 MARKETING AND SOCIAL MEDIA WEB ANALYTICS L T P C
(COMMON TO ALL BRANCHES) 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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BoS (CIVIL)

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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BoS (CIVIL)

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, Obere, 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, Newnes, 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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