MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE MADANAPALLE

(UGC-AUTONOMOUS)
www.mits.ac.in

BACHELOR OF TECHNOLOGY

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE
&
DETAILED SYLLABI

For the students admitted to
B. Tech in Electronics and Communication Engineering Academic year 2020-21 Batches onwards
and
B. Tech. Lateral Entry Scheme from the academic year 2021-22

B. Tech Regular Four Year U. G. Degree Course

Vision and Mission of the Institution

Vision	To become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation
Mission	To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

Vision and Mission of the Department

Vision	To excel in technical education and research in the area of Electronics and Communication Engineering and to produce skilled, trained and competent individuals with high motivation to meet the present-day challenges of the society.
Mission	➢ To impart high quality education to enable students face challenges in the fields of Electronics and Communication Engineering. ➢ To provide facilities, infrastructure, environment to develop the spirit of innovation, creativity, and research among students and faculty. ➢ To inculcate ethical, moral values and lifelong learning skills in students to address the societal needs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: For successful employment in Electronics and Communication Engineering.

PEO2: To design, test and develop the state-of-the-art hardware and software in Electronics and Communication Engineering.

PEO3: For lifelong learning skills, societal ethics and higher education

PROGRAM OUTCOMES (POs)

At the end of the programme, graduate will be able to

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norm of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Design and analyse systems in the field of Electronics and Communication Engineering.

PSO 2: Apply the concepts to design and develop solutions in the field of VLSI & Embedded System.

PSO 3: Analyse and develop hardware/software applications in the field of Signal & System Engineering.

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRONICS AND COMMUNICATION ENGINEERING

Total Credits	160 Credits for 2020(Regular) & 121 Credits for 2021(Lateral Entry) Admitted Batch
	163 Credits for 2021(Regular) & 124 Credits 2022(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	**Title**	**Duration**
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year (Refer Annexure - I)
2	Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)	Three hours per week (Activity list is enclosed in Annexure - I)

R20 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20ENG101	Professional English	3	0	0	3	3
2	BSC	20MAT101	Engineering Calculus	3	1	0	4	4
3	BSC	20CHE101	Engineering Chemistry	3	0	0	3	3
4	ESC	20ME101	Engineering Graphics	2	0	2	4	3
5	ESC	20CSE101	Programming for Problem Solving (Python)	2	0	3	5	3.5
6	BSC	20CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	ESC	20ME201	Workshop Practice	0	0	3	3	1.5
Total				**13**	**1**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT107	Linear Algebra, Complex Variables and Ordinary Differential Equations	3	0	0	3	3
2	BSC	20PHY102	Applied Physics	3	1	0	4	4
3	ESC	20EEE101	Basic Electrical Engineering	3	1	0	4	4
4	ESC	20CSE102	C Programming and Data Structures	3	0	0	3	3
5	HSMC	20ENG201	English for Professional Purposes Laboratory	0	0	2	2	1
6	BSC	20PHY201	Physics Laboratory	0	0	3	3	1.5
7	ESC	20EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
8	ESC	20CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
Total				**12**	**2**	**11**	**25**	**19.5**

(L = Lecture, T = Tutorial, P = Practical)

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	BSC	20MAT113	Transforms and Partial Differential Equations	3	0	0	3	3
3	ESC	20ECE101	Network Theory	2	1	0	3	3
4	PCC	20ECE102	Digital System Design	2	1	0	3	3
5	PCC	20ECE103	Electronic Devices and Circuits	3	0	0	3	3
6	PCC	20ECE201	Networks and Simulation Laboratory	0	0	3	3	1.5
7	PCC	20ECE202	Digital System Design Laboratory	0	0	3	3	1.5
8	PCC	20ECE203	Electronic Devices and Circuits Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course -I (Refer ANNEXURE IV)	1	0	2	3	2
10	MC	20HUM901	Indian Constitution	2	0	0	2	0
Total				**16**	**2**	**11**	**29**	**21.5**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT109	Probability Theory and Stochastic Process	3	0	0	3	3
2	PCC	20ECE104	Control Systems Engineering	2	1	0	3	3
3	PCC	20ECE105	Principles of Signals and Systems	2	1	0	3	3
4	PCC	20ECE106	Analog Circuits	3	0	0	3	3
5	PCC	20ECE107	Microprocessors and Microcontrollers	3	0	0	3	3
6	PCC	20ECE204	Simulation and Control Laboratory	0	0	3	3	1.5
7	PCC	20ECE205	Analog Circuits Laboratory	0	0	3	3	1.5
8	PCC	20ECE206	Microprocessors and Microcontrollers Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course -II (Refer ANNEXURE IV)	1	0	2	3	2
10	MC	20CHE901	Environmental Science	2	0	0	2	0
Total				**16**	**2**	**11**	**29**	**21.5**

(L = Lecture, T = Tutorial, P = Practical)

III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20ECE108	Electromagnetic Fields and Transmission Lines	2	1	0	3	3
2	PCC	20ECE109	Analog Communication	3	0	0	3	3
3	PCC	20ECE110	Digital Signal Processing	2	1	0	3	3
4	OE		Open Elective-I	3	0	0	3	3
	PE		Professional Elective-I	3	0	0	3	3
6	PCC	20ECE207	Analog Communication Laboratory	0	0	3	3	1.5
7	PCC	20ECE208	Digital Signal Processing Laboratory	0	0	3	3	1.5
8	SC		Skill Oriented Course -III (Refer ANNEXURE IV)	1	0	2	3	2
9	MC	20HUM902**/ 20HUM102#	Universal Human Values	2/3	0	0	2/3	0/3
10	PROJ	20ECE701	Summer Internship-1*	0	0	3	3	1.5
Total				**16/17**	**2**	**11**	**29/30**	**21.5/24.5**

** 20HUM902 Universal Human Values is offered as non-credit mandatory course for 2020 (Regular) & 2021 (Lateral Entry) Admitted Batch

20HUM102 Universal Human Values is offered as three credit course for 2021 (Regular) & 2022(Lateral Entry) Admitted Batch onwards

* 2 Months internship during 2nd year summer vacation and to be evaluated in III Year I Semester

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20ECE111	VLSI Design	3	0	0	3	3
2	PCC	20ECE112	Antenna and Microwave Engineering	3	0	0	3	3
3	PCC	20ECE113	Digital Communication	3	0	0	3	3
4	OE		Open Elective-II	3	0	0	3	3
5	PE		Professional Elective-II (MOOCS)	3	0	0	3	3
6	PCC	20ECE209	VLSI Design Laboratory	0	0	3	3	1.5
7	PCC	20ECE210	Microwave Engineering Laboratory	0	0	3	3	1.5
8	PCC	20ECE211	Digital Communication Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course-IV (Refer ANNEXURE IV)	1	0	2	3	2
10	MC	20CE901	Disaster Management	2	0	0	2	0
Total				**18**	**0**	**11**	**29**	**21.5**

(L = Lecture, T = Tutorial, P = Practical)

IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PE		Professional Elective-III	3	0	0	3	3
2	PE		Professional Elective-IV	3	0	0	3	3
3	PE		Professional Elective-V	3	0	0	3	3
4	OE		Open Elective-III (MOOCS)	3	0	0	3	3
5	OE		Open Elective-IV	3	0	0	3	3
6	OE-HSMC		Open Elective-V (Taken from Humanities & Social Science)	3	0	0	3	3
7	SC		Skill Oriented Course -V (Refer ANNEXURE IV)	1	0	2	3	2
8	PROJ	20ECE702	Summer Internship-2*	0	0	6	6	3
Total				**19**	**0**	**8**	**27**	**23**

* 2 Months' internship during 3rd year summer vacation and to be evaluated in IV Year I Semester

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	20ECE703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical)

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

    - Basic Computer Proficiency
    - Interpersonal skills
    - Computer Graphics
    - Web programming
    - Mobile Apps
    - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

OPEN ELECTIVE – I

(To be offered under MOOC's Category from SWAYAM – NPTEL)

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20HUM3M03	E – Business	Management Studies
4	20CE3M01	Integrated Waste Management for Smart City	Civil
5	20CE3M02	Soil and Water Conservation Engineering	Civil
6	20CE3M03	Plastic Waste Management	Civil
7	20CE3M04	Safety in Construction	Civil
8	20ME3M01	Operations Management	Mechanical
9	20ME3M02	Operations Research	Mechanical
10	20ME3M03	Design Thinking and Innovation	Mechanical
11	20EEE3M01	Non-Conventional Energy Sources	EEE
12	20EEE3M02	Design of Photovoltaic Systems	EEE
13	20CSE3M01	Online Privacy	CSE
14	20CSE3M02	Privacy and Security in Online Social Media	CSE
15	20CSE3M03	Computer Architecture	CSE
16	20CSE3M04	Computer Architecture and Organization	CSE
17	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
18	20IE3M02	Introduction to Research	Multidisciplinary
19	20IE3M03	Roadmap for Patent Creation	Multidisciplinary
20	20IE3M04	Energy Conversion Technologies (Biomass And Coal)	Multidisciplinary
21	20IE3M05	Research Methodology	Multidisciplinary

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.

OPEN ELECTIVE – II

(To be offered under Conventional Mode)

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	20MAT301	Advanced Numerical Methods	Mathematics
2	20MAT302	Engineering Optimization	Mathematics
3	20PHY301	Optical Physics and its Applications	Physics
4	20PHY302	LASER Physics and Advanced LASER Technology	Physics
5	20CHE301	Introduction to Petroleum Industry	Chemistry
6	20CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	20CE301	Ground Improvement Techniques	Civil
8	20CE302	Environmental Impact Assessment	Civil
9	20CE303	Watershed Management	Civil
10	20ME301	Material Science for Engineers	Mechanical
11	20ME302	Elements of Mechanical Engineering	Mechanical
12	20EEE301	Industrial Electrical Systems	EEE
13	20EEE302	Introduction to MEMS	EEE
14	20CSE301	JAVA Programming	CSE
15	20CSE302	Multimedia Technologies	CSE
16	20CST301	Operating Systems	CST
Any new Interdisciplinary courses can be appended in future.			

OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M04	Management Information System	Management Studies
2	20HUM3M05	Business Analytics & Text Mining Modeling Using Python	Management Studies
3	20CE3M05	Remote Sensing and GIS	Civil
4	20CE3M06	Wastewater Treatment and Recycling	Civil
5	20CE3M07	Building Materials And Composites	Civil
6	20ME3M04	Power Plant Engineering	Mechanical
7	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
8	20EEE3M03	Introduction to Smart Grid	EEE
9	20CSE3M05	Software Testing	CSE
10	20CSE3M06	Multi-Core Computer Architecture	CSE
11	20CSE3M07	Introduction to Machine Learning	CSE
12	20CST3M01	Ethical Hacking	CST
13	20IE3M06	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20PHY303	Thin Film Technology and its Applications	Physics
2	20CHE303	Introduction to Nano Science and Technology	Chemistry
3	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
4	20CE304	Green Buildings and Energy Conservation	Civil
5	20CE305	Environmental Engineering	Civil
6	20ME303	Total Quality Management	Mechanical
7	20ME304	Entrepreneurship	Mechanical
8	20EEE303	Robotics	EEE
9	20EEE304	Electrical Safety	EEE
10	20CSE303	Mobile Application Development	CSE
11	20CSE304	Software Project Management	CSE
12	20CST302	Cloud Computing	CST
Any new Interdisciplinary courses can be appended in future.			

OPEN ELECTIVE – V (HUMANITIES) (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM301	Principles of Management	Humanities
2	20HUM302	Human Resource Development	Humanities
3	20HUM303	Soft Skills	Humanities
4	20HUM304	National Cadet Corps	Humanities
Any new Interdisciplinary courses can be appended in future.			

ANNEXURE - III

List of Professional Elective – ECE

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE401	Nano Electronics
2.	20ECE402	Electronics Packaging and Testing
3.	20ECE403	Bio-Medical Electronics
4.	20ECE404	Advanced Digital System Design using Verilog HDL
5.	20ECE405	Embedded Systems
Any advanced courses can be appended in future.		

Professional Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE4M01	Foundations of Cryptography
2.	20ECE4M02	Semiconductor Opto-Electronics
3.	20ECE4M03	Computer Networks and Internet Protocol
4.	20ECE4M04	VLSI Signal Processing
5.	20ECE4M05	An Introduction to Information Theory
6.	20ECE4M06	Communication Networks
7.	20ECE4M07	Fuzzy Logic And Neural Networks
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE406	Fiber Optic Communication
2.	20ECE407	Software for Embedded systems
3.	20ECE408	Wireless Communication
4.	20ECE409	FPGA based System Design
5.	20ECE410	Cognitive Radio
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE411	Pattern Recognition and its Applications
2.	20ECE412	Mobile Communication Networks
3.	20ECE413	RADAR Engineering
4.	20ECE414	Speech and Audio Processing
5.	20ECE415	DSP Architecture
Any advanced courses can be appended in future.		

Professional Elective –V		
Sl. No.	**Course Code**	**Course Title**
1	20ECE416	Digital Image and Video Processing
2	20ECE417	Wireless Sensor Networks
3	20ECE418	Satellite Communication
4	20ECE419	Error Correcting Codes
5	20ECE420	RFICs
6	20ECE421	Community Radio Technology
Any advanced courses can be appended in future.		

ANNEXURE - IV

List of Skill Oriented Courses

Skill Oriented Course – I		
Sl. No.	**Course Code**	**Course Title**
1.	20ENG601	Corporate Communication
Any Courses in Communication Skills can be appended in future.		

Skill Oriented Course – II		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE601	Python for Data Science
2.	20ECE602	Sensors and Instrumentation
4.	20ECE603	MATLAB for Engineers
Any Courses can be appended in future.		

Skill Oriented Course – III		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE604	Printed Circuit Board (PCB) Designing
2.	20ECE605	Artificial Intelligence Foundations
3.	20ECE606	Object Oriented Programming using C++
Any Courses can be appended in future.		

Skill Oriented Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE607	Real Time Operating Systems (RTOS)
2.	20ECE608	Internet of Things
Any Courses can be appended in future.		

Skill Oriented Course – V		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE609	Digital Signal Processor
2.	20ECE610	Antenna Design
Any Courses can be appended in future.		

Annexure V

Minor in Electronics and Communication Engineering

(Applicable to CE, EEE, ME, CSE, CST , CS – AI, CS – DS, CS – CSY and CSE - IOT)

Stream Name: Communication Systems (CS)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	20MDECE101	Electronics Engineering: Basic Principles and Applications (Except EEE Branch)	3	0	0	3	3
	Professional Core Course	20MDECE102	Computer Communication Networks(for EEE Branch)					
2	Professional Core Course	20MDECE103	Analog and Digital Communications	3	0	0	3	3
III Year II Semester								
3	Professional Core Course	20MDECE104	Satellite Communication	3	0	0	3	3
4	Professional Core Course	20MDECE105	Optical Communication	3	0	0	3	3
5	Professional Core Course	20MDECE201	Analog and Digital Communications Laboratory	0	0	4	4	2
IV Year I Semester								
6	Professional Core Course	20MDECE106	Mobile Telecommunication Networks	3	0	0	3	3
7	Professional Core Course	20MDECE107	DSP Integrated Circuits	3	0	0	3	3
			Total	**18**	**0**	**4**	**22**	**20**

Minor in Electronics & Communication Engineering
(Applicable to CE, EEE, ME, CSE, CST , CS – AI, CS – DS, CS – CSY and CSE - IOT)

Stream Name: Embedded Systems (ES)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	20MDECE101	Electronics Engineering: Basic Principles and Applications (Except EEE Branch)	3	0	0	3	3
	Professional Core Course	20MDECE108	Computer Architecture (For EEE Branch)					
2	Professional Core Course	20MDECE109	Advanced Microprocessors	3	0	0	3	3
III Year II Semester								
3	Professional Core Course	20MDECE110	Microcontroller Programming with TI- MSP 430	3	0	0	3	3
4	Professional Core Course	20MDECE111	ARM – System on Chip Architecture	3	0	0	3	3
5	Professional Core Course	20MDECE202	Microprocessor and Microcontroller Laboratory	0	0	4	4	2
IV Year I Semester								
6	Professional Core Course	20MDECE112	Real Time Operating Systems	3	0	0	3	3
7	Professional Core Course	20MDECE113	Testing of Digital VLSI Circuits	3	0	0	3	3
			Total	**18**	**0**	**4**	**22**	**20**

Annexure VI

Honors in Electronics & Communication Engineering

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	20HDECE101	Mixed Signal Processing	3	0	0	3	3
2		20HDECE102	Testing of Digital VLSI Circuits	3	0	0	3	3
3		20HDECE103	DSP Integrated Circuits	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	III Year II Semester							
4	**Professional Elective Course (Choose any two from three courses)**	20HDECE104	Advanced Digital Signal Processing	3	0	0	3	3
5		20HDECE105	System on Chip Design	3	0	0	3	3
6		20HDECE106	Low Power VLSI Design	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	IV Year I Semester							
7	**Professional Elective Course (Choose any two from three courses)**	20HDECE107	Advanced Communication Networks	3	0	0	3	3
8		20HDECE108	CAD for VLSI Circuits	3	0	0	3	3
9		20HDECE109	ASIC Design	3	0	0	3	3
10	**SOC**	20HDECE601	Advanced RF Transmission, Reception, and Signal Processing	1	0	2	3	2
	Sub Total			**7**	**0**	**2**	**9**	**8**
	Total			**19**	**0**	**2**	**21**	**20**

I YEAR I SEMESTER

B. Tech I Year I Semester

20ENG101 PROFESSIONAL ENGLISH

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I GRAMMAR & VOCABULARY 9 hours

Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.

UNIT II READING SKILLS & WRITTEN COMMUNICATION 9 hours

Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence.

UNIT III VERBAL & NON-VERBAL ASPECTS 9 hours

Verbal - Introducing oneself, exchanging personal information, Using 'Wh'- Questions, asking and answering, yes or no questions- asking about routine actions and expressing opinions; Non-Verbal – Use of body language, combating nervousness.

UNIT IV CONVERSATIONS 9 hours

Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, sharing information of a personal kind speaking about one's friend.

UNIT V BUSINESS ENVIRONMENT & ETIQUETTES 9 hours

Greeting & taking leave; Writing e-mails, memos, reports, etc.

Course Outcomes:

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

1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Text Books:

1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.

2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference Books:

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press, 2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012.
8. http://www.cambridgeenglish.org/in/
9. https://www.rong-chang.com/
10. https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech I Year I Semester

20MAT101 ENGINEERING CALCULUS

L	T	P	C
3	1	**0**	**4**

Pre-requisite: Mathematics at Intermediate or Equivalent Level

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. To introduce the basic concepts of definite integrals, improper integrals, Beta and Gamma functions.
2. To acquire knowledge on mean value theorems in calculus.
3. To illustrate various techniques of testing the convergence of infinite series and introduces the functions of sine and cosine series.
4. To familiarize the knowledge of limit, continuity and the derivatives, extreme values in Multivariable.
5. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.

UNIT I INTEGRAL CALCULUS 12 hours

Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

UNIT II DIFFERENTIAL CALCULUS 12 hours

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima.

UNIT III SEQUENCE AND SERIES 12 hours

Sequence and Series, their Convergence and tests for convergence; Power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV MULTIVARIABLE DIFFERENTIAL CALCULUS 12 hours

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT V MULTIVARIABLE INTEGRAL CALCULUS 12 hours

Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes (double integration), triple integrals, gradient, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs).

Course Outcomes:

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

1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Relate the results of mean value theorems in calculus to Engineering problems.
3. Use the Power series and Fourier series for ascertaining the stability and convergence of various techniques.

4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.
2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11th Edition, 2004.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2 Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3 Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4 Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5 D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6 N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year I Semester

20CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:
Students will

1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry

UNIT I IMPURITIES PRESENT IN WATER AND WATER TREATMENT 9 hours

Impurities present in Water: Impurities in water (BIS and WHO standards), Hardness of water-determination of hardness - EDTA Method (numerical problems), Alkalinity of water (numerical problems), Estimation of Dissolved Oxygen by Winkler's method and its importance and Chlorides. Disadvantages (industry level) of using hard water (Boiler corrosion, Caustic embrittlement, Scale and Sludges). Softening of water (Ion exchange method), Treatment of brackish water by Reverse Osmosis method. Water treatment for civic applications: coagulation, sedimentation, filtration, sterilization - chlorination and ozonation. Concept of break point chlorination.

UNIT II PERIODIC PROPERTIES AND ORGANIC REACTIONS 7 hours

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (SN^1 and SN^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism).

UNIT III SPECTROSCOPY 8 hours

Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy

UNIT IV THERMODYNAMICS AND ELECTROCHEMISTRY 11 hours

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes. Electrochemistry: Free energy and EMF. Cell potentials, the Nernst equation and applications. Batteries (Lead-Acid and Lithium ion) and Fuel-Cells (H_2-O_2).

UNIT V ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY 10 hours

Engineering Materials: Cement Materials and Manufacturing Process. Reactions in setting and hardening of Cement. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials: Solar Energy and Photocatalytic Dye Degradation (TiO_2).

Course Outcomes:

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

1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies.
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry, and daily life.

Text Books:

1. P. W. Atkins & Julio de Paula, ‘The Elements of Physical Chemistry’, Ninth edition (Oxford University Press, Oxford 2010)
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
3. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
4. Dr. S. S. Dara and Dr. S. S. Umare, A Textbook of Engineering Chemistry,1 st Edition., (S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1 st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

Reference Books

1. ‘Physical Chemistry’, D. W. Ball, First Edition, India Edition (Thomson, 2007).
2. Perry’s Chemical Engineers’ Handbook, Don W. Green and Marylee Z. Southard, 9th Edition (McGraw Hill, 2018).
3. Engineering Chemistry, Dr. Suba Ramesh and others, 1st Edition (Wiley India, 2011).
4. Jain and Jain, Engineering Chemistry,16th Edition (Dhanpat Rai Publishing Company (P) Ltd, 2016).
5. Amretashis Sengupta, Chandan Kumar Sarkar (eds.), Introduction to Nano Basics to Nanoscience and Nanotechnology (Springer-Verlag, Berlin, Heidelberg, 2015)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year I Semester

20ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:
1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I INTRODUCTION TO AUTO CAD 12 hours
Introduction to AutoCAD commands, simple drawings using AutoCAD, Introduction to orthographic Projections – Theory, techniques, first angle projections and third angle projections.

UNIT II PROJECTIONS OF POINTS & LINES 12 hours
Projections of points: Positions, notation system and projections. Projections of lines: Positions, terms used, different cases, traces of lines and finding true length.

UNIT III PROJECTIONS OF PLANES & SOLIDS 12 hours
Projections of planes: Positions, terms used, different cases and projections procedure.
Projections of Solids: Projections of Regular Solids inclined to one plane (resting only on HP).

UNIT IV SECTIONS AND DEVELOPMENTS OF SOLIDS 12 hours
Section of solids: Sectional view of right regular solids (Prism and cylinder), true shapes of the sections.
Development of Surfaces: Development of surfaces of right regular solids (Prism, Cylinder and their Sectional Parts).

UNIT V INTERSECTIONS & ISOMETRIC PROJECTIONS 12 hours
Intersections of surfaces of solids: Intersection between prism Vs prism, prism Vs cylinder, cylinder Vs cylinder.
Isometric Projections: Theory of isometric drawing and orthographic views, Conversion of isometric view into orthographic views.

Course Outcomes:
Student will be able to
1. Identify various commands in AutoCAD software and apply AutoCAD skills to develop the new designs.
2. Draw the projections of points, straight lines using AutoCAD.

3. Draw the projections of the planes, solids using AutoCAD
4. Sketch the developments of solids, sections of solids using AutoCAD.
5. Draw the conversion of the isometric views to orthographic views and intersections of surfaces using AutoCAD.

Text Books:

1. D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.

2 N D Bhat, Engineering Drawing, Charotar Publishing House, Gujarath,15th Edition, 2010.

3 K.L. Narayana, P. Kanniah, Engineering Drawing, Scitech Publishers, 2nd Edition, 2010.

Reference Books:

1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008.

2 Warren J. Luzadder & Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year I Semester

20CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	3	3.5

Pre-requisite: None

Course Description:
Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience.
This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts

Course Objectives:
This course enables students to
1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.
6. Getting exposed to the basics of Object Oriented Programming using Python

UNIT I: INTRODUCTION 12 hours
Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Data Types - Integers, Strings, Boolean.
a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

UNIT II: OPERATORS AND EXPRESSIONS 12 hours
Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow - if, if-elif else, for, while, break, continue, pass.
a) Swapping of two number with and without using temporary variable.
b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:
- For code '+', perform addition.
- For code '-', perform subtraction.
- For code '*', perform multiplication.
- For code '/', perform division.

d) Implement the python program to generate the multiplication table.
e) Implement Python program to find sum of natural numbers
f) If the first name of a student is input through the keyboard, write a program to display the vowels and

consonants present in his/her name.

g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

% OBTAINED GRADE
90 - 100 O (Outstanding)
80 - 89 A+ (Excellent)
70 - 79 A (Very Good)
60 - 69 B+ (Good)
50 - 59 B (Above)
45 - 49 C (Average)
40 - 44 P (Pass)
< 40 F (Fail)

h) Implement Python Script to generate prime numbers series up to N.

i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.

UNIT-III: DATA STRUCTURES 12 hours

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Functions - Defining Functions, Calling Functions, Passing Arguments, variable in python-Global and Local Variables.

a) Write a Python script to
- create a list
- access elements from a list
- slice lists
- change or add elements to a list
- delete or remove elements from a list

b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.

c) Write a Python script to compute the similarity between two lists.

d) Write a Python script to read set of values from a Tuple to perform various operations.

e) Write a Python script to perform basic dictionary operations like insert, delete and display.

f) Write a Python program to count the occurrence of each word in a given sentence.

g) Define a dictionary named population that contains the following data.

Keys	Values
Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.

i) Implement Python script to display power of given numbers using function.

j) Implement a Python program that takes a list of words and returns the length of the longest one using function.

UNIT-IV:

String Handling -Modules: Creating modules, import statement, from import statement, name spacing

Files and Directories:

a) Implement Python program to perform various operations on string using string libraries.

b) Implement Python program to remove punctuations from a given string.

c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is “computer”, your program should output “COMPUTER” without using library functions.

d) Implement Python program to capitalize each word in a string. For example, the entered sentence “god helps only people who work hard” to be converted as “God Helps Only People Who Work Hard”

e) Write a Python script to display file contents.

f) Write a Python script to copy file contents from one file to another.

g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.

h) Write a Python commands to perform the following directory operations.

- List Directories and Files
- Making a New Directory
- Renaming a Directory or a File
- Removing Directory or File

UNIT-V:

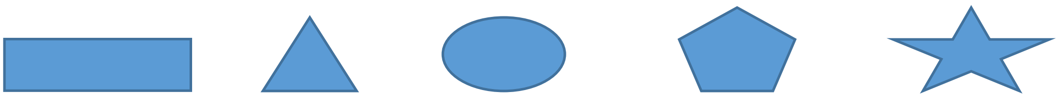
Python packages: Predefined Packages and User-defined Packages, Package Creation.
Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python, Creating Methods in Python
Brief Tour of the Standard Library: Turtle

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.

b) Create a class by name Student with instance variables such as roll_no, name, year_of_study, branch, section, and marks in any five subjects. The class should also contain one method for calculating the percentage of marks and the other method for printing a report as follows:

Roll No.	Name	Year	Section	Branch	M1	M2	M3	M4	M5	Percentage
101	Abc	I	A	CSE	58	68	95	47	56	64.8

b) Write a python script to display following shapes using turtle.



Course Outcomes:

At the end of the course, students will be able to
1. Understand problem solving techniques and their applications
2. Understand the syntax and semantics of python.
3. Demonstrate the use of Python lists and dictionaries.
4. Demonstrate the use of Python File processing, directories.
5. Describe and apply object-oriented programming methodology and Standard Library.

Text Books:

1. 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/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of volumetric and instrumental analytical methods.

Course Objectives:
This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to Students will

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.
2. Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus
5. highlighting the role of chemistry in engineering.

LIST OF EXPERIMENTS

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of dissolved oxygen by Winkler's method.
4. Determination of molecular weight of a polymer by using Ostwald's viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H_2SO_4) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
9. Determination of percentage of Iron in Cement sample by colorimetry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.
12. Formation of Iron-1,10-phenanthroline complex and determination of iron by colorimetry.

Course Outcomes:

After the completion of the Engineering Chemistry Laboratory experiments, students will be able to

1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation, and redox titrations, respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer Lambert's Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.

Textbook:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.
3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.
4. A Textbook on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Pre-requisite None

Course Description:
This course will provide students with a hands-on experience on various basic engineering practices. This course will also provide an opportunity to the students to experience the various steps involved in the industrial product fabrication.

Course Objectives:
1. Introduction to the use of Tools, Machinery and Power tools,
2. Hands on practice in Carpentry, Fitting, Forging, Tinsmith, Plumbing, Foundry, Welding, Fabrication of plastic components, Metrology, Fabrication of Polymer Composite materials, simple machine turning and wood turning, and basic electrical connections.
3. Introduction to 3 D Printing
4. Fabrication of final product at end of the semester

LIST OF TRADES
1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and 'V' fit)
3. Turning (Ball pane hammer and handles)
4. Forging (S hook L hook)
5. Tin smithy (Square tray)
6. Plumbing (Wash basin and simple connection)
7. Foundry (Solid and Split pattern)
8. Welding (Arc and Gas welding)
9. Fabrication of plastic components (Pen Stand)
10. Metrology (Internal and External dimension)
11. Composite Material Sample Preparation (Demo Only)
12. Introduction of Power Tools and CNC (Demo Only)
13. Introduction to 3D Printing (Demo Only)

Course Outcomes:

On successful completion of this course, the student will be able to
1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Perform welding operation to join various structures.
3. Perform basic machining operations.
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabricate a product using composite and plastic material
7. Design and fabricate a product using the tools and skills learned in the workshop

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

3. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998. (v) Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.
4. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House,2017.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

I YEAR II SEMESTER

B. Tech I Year II Semester

20MAT107 LINEAR ALGEBRA, COMPLEX VARIABLES AND ORDINARY DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre-requisite: **20MAT101**

Course Description:

This course introduces the topics involving: Linear Algebra, Complex variable functions, Ordinary Differential Equations and their applications. The course starts with algebra of matrix, systems of linear equations and with preliminary course on complex variable. It introduces the CR equation, analytic function, Taylor and Laurent series expansions and determination of residues. Emphasis also placed on the development of concepts and applications for first and second order ordinary differential equations (ODE), systems of differential equations and Laplace transforms.

Course Objectives:

1. To solve the system of linear equations, and develop orthogonal transformation with emphasis on the role of Eigenvalues and Eigenvectors.
2. To analyze the function of complex variable and its analytic property with a review of elementary complex function.
3. To understand the Taylor and Laurent expansion with their use in finding out the residue and improper integral.
4. To identify important characteristics of ODE and develop appropriate method of obtaining solutions of ODE.
5. Explore the use of ODE as models in various applications to solve initial value problems by using Laplace transform method.

UNIT I MATRICES 9 hours

Symmetric, Skew-symmetric and Orthogonal matrices, Determinants, System of linear equations, Inverse and rank of a matrix, rank-nullity theorem, Eigen values and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem, and Orthogonal transformation.

UNIT II COMPLEX VARIABLE - DIFFERENTIATION 9 hours

Differentiation, Cauchy-Riemann equations, Analytic function, Harmonic functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT III COMPLEX VARIABLE - INTEGRATION 9 hours

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's expansion (without proof), Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

UNIT IV FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Exact, Linear and Bernoulli's, Equations not of first degree: equations solvable for p, equations solvable for x, equations solvable for y and Clairaut's type.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS 9 hours

Second and higher order linear differential equations with constant coefficients and variable coefficients, Method of variation of parameters.

Course Outcomes:

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

1. Solve the systems of linear equations occurring in engineering system.
2. Determine harmonic function, velocity potential and stream lines in fluid flow systems.
3. Evaluate a contour integral and definite integral involving exponential, sine and cosine functions.
4. Find general solutions to first and second order homogeneous differential equations by algebraic and computational methods.
5. Determine the solution of ODE of second and higher order.

Text Books:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, 42nd Edition, Khanna Publishers.
2. Complex variables and applications by R. V Churchill and J. W. Brown, 8th edition, 2008, McGraw-Hill.

Reference Books

1. Elementary linear Algebra by Stephen Andrilli and David Hecker, 4th Edition, Elsevier, 2010.
2. Ordinary and partial differential equations. By M.D. Raisinghania, 2013. S. Chand Publishing.
3. Differential Equations with applications and historical notes by G.F. Simmons second edition, McGraw Hill, 2003.
4. Linear Algebra and its Applications by D.C. Lay, 3rd edition, Pearson Education, Inc.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year II Semester

20PHY102 APPLIED PHYSICS

L	T	P	C
3	1	0	4

Pre-requisite: Plus two level physics course

Course Description:
Applied Physics for Electrical, Electronics and Computer Engineers is a basic physics course which provides fundamental knowledge to understand the concepts of Waves, Optics, Quantum Mechanics, Semiconductors, Lasers and Fiber Optics.

Course Objectives:
1. Expose students in understanding the basic laws of nature through wave equation using the principles of oscillations and waves.
2. Analyze and understand the concepts of waves and optics to prepare the students for advanced level courses.
3. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques, Polarization and Lasers for testing of materials.
4. Develop knowledge and understanding the fundamental concepts of Quantum mechanics, Semiconductors and Fiber Optics.
5. Adaptability to new developments in science and technology.

UNIT I WAVES AND OSCILLATIONS 11 hours
Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures.
Transverse waves, one dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT II OPTICS 13 hours
Superposition of waves, interference of light by division of wavefront - Young's double slit experiment, interference of light by division of amplitude- interference in thin film by reflection, Newton's rings experiment.
Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (Nslit).
Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol's prism. Half wave and Quarter wave plates.

UNIT III QUANTUM MECHANICS 12 hours
De Broglie's hypothesis, Uncertainty principle (Qualitative only), Postulates of quantum mechanics, Time-dependent and time-independent Schrodinger equations for wave function, Free-particle wave function and wave-packets (group velocity & phase velocity), Solution of wave equation: Solution of stationary-state, Schrodinger equation for one dimensional problems – particle in a box, Scattering from a potential barrier and principle of tunnelling- operation of scanning tunnelling microscope.

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 12 hours
Free electron theory of metals (drift velocity and electrical conductivity), Fermi energy level, density of states, Kronig-Penney model (Qualitative only) and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect bandgap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Drift and Diffusion Current, Hall effect.

UNIT V LASERS & FIBER OPTICS 12 hours

Introduction to lasers, characteristics of laser, spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, solid-state lasers – ruby laser, gas Lasers - He-Ne Laser, applications of lasers.

Fiber Optics: Principle, Construction and working of optical fiber, Acceptance angle, Numerical aperture, Types of fiber, Fiber optic communication system.

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Describe a mathematical wave equation using the principles of waves and oscillations
2. Apply the knowledge for materials testing using Interference, Diffraction & Polarization techniques.
3. Understand the idea of wave function and to solve Schrodinger equation for simple potentials.
4. Explain the role of semiconductors in different realms of physics and their applications in both science and technology.
5. Acquire the basic knowledge of lasers and fiber optics.

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

2. Engineering Physics –K. Thyagarajan, McGraw Hill Publishers.

Reference Books:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
4. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year II Semester

20EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

Pre-requisite: Intermediate Physics

Course Description:
This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic materials, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:
1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic material and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I DC CIRCUIT ANALYSIS 12 hours
Electrical circuit elements, voltage and current sources, Series and parallel resistive circuits, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits with dc excitation. Source Transformation, Star-Delta Transformation, Superposition Theorem.

UNIT II AC CIRCUIT ANALYSIS 12 hours
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III MAGNETIC MATERIALS AND TRANSFORMERS 12 hours
Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV DC AND AC MACHINES 12 hours
Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Introduction to different types of AC motors, Three Phase Induction Motors - Generation of rotating magnetic fields, construction, working and starting methods: D.O.L, Autotransformer starter. Introduction to Alternators.

UNIT V RECTIFIERS AND ELECTRICAL INSTALLATIONS 12 hours
PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables – Current carrying capability, Insulation Strength; Earthing.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Reference Books:

1. Abhijit Chakrabarti, “Circuit Theory : Analysis and Synthesis”, Dhanpat Rai & Co., 2014.
2. J.B. Gupta, “Theory & Performance of Electrical Machines”, S. K. Kataria & Sons, 2013.
3. John Bird, “Electrical Circuit Theory and Technology”, Fourth edition, Elsevier Ltd., 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech I Year II Semester

20CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To understand the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stack, queue, and linked list.

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours

Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions.
Control Structures: Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

UNIT II FUNCTIONS & ARRAY 9 hours

Functions Introduction, User defined function, Function prototype, Function Definition and Function Call, Storage classes, Recursion **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. Passing array as an argument to function. **Sorting:** Bubble Sort, Insertion Sort, selection sort. **Searching:** Linear and binary search.

UNIT III STRINGS & POINTERS 9 hours

Strings: Declaring and defining a string, Initialization of strings, Strings Library functions.
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference, Dynamic memory allocation.

UNIT IV STRUCTURES & FILES 9 hours

Structures: Defining a structure, processing a structure, Pointer to Structure, Unions.
Files: Opening and closing a data file, Reading and Writing a data file, File I/O Functions.

UNIT V DATA STRUCTURES 12 hours

Stack: stack operations, stack implementations using arrays.
Queue: queue operations, queue implementations using array, Applications of stack and queue.
Linked List: Single linked list operations.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design and implement applications using functions, arrays, sorting and searching techniques.
3. Design and implement applications using strings and pointers.
4. Design and implement applications using structures and File processing.
5. Choose appropriate linear data structure depending on the problem to be solved.

Text Books:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition, Prentice Hall, India 1988.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

Reference Books:

1. Let us C, Yashavant Kanetkar, 15th Edition, BPB Publications, 2016.
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5th edition, 2007.
3. K. N. King ,"C Programming ": A Modern Approach, 2nd Edition 2nd Edition.
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year II Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY

(Common to all branches)

L	T	P	C
0	0	2	1

Pre-requisite: None

Course Description:

English language communication is a social phenomenon and students need to be able to function in the society at large as the communicators before entering the professional world. The present course equips the students with the basic functions of English language communication, which are required not only in their day-to-day lives but also profoundly significant for their future professional, academic training and their careers in the industry. The course mainly focuses on the achievement of communicative proficiency of the students coupled with the necessary linguistic inputs.

Course Objectives:

This course enables the student to –

1. Get aquatinted with the basic communicative functions.
2. Engage effectively in learning various functions of English language communication.
3. Enhance their narration abilities in past experiences and future plans and goals/events.
4. Develop their abilities in expressing opinion.
5. Provide speaking practice in speech.

Course contents:

Greeting and Introductions (L & S)

- Greeting on different occasions and responding to greetings **(L & S)**
- Wishing on various occasions, taking leave and saying goodbye **(L & S)**
- Introducing oneself and others **(L & S)**
- Asking for introduction and responding to introduction **(L & S)**
- Developing a short personal profile **(R &W)**

Describing: (L, S, R & W)

- Using adjectives **(Vocab)**
- Degrees of comparison **(Grammar)**
- Common words, phrases, and expressions used for description **(Vocab)**
- Describing people, places and objects **(L, S, R & W)**
- Reading and writing descriptive paragraphs **(R &W)**

Narrating (L, S, R & W)

- Talking about past experiences and events **(L & S)**
- Talking about memorable incidents or events **(L & S)**
- Techniques of narration and narrative tenses **(Grammar)**
- Composing and narrating a story **(R &W)**

Planning and Predicting (L, S, R & W)

- Talking about future events **(L & S)**
- Making promises and giving assurances **(L & S)**
- Predicting future events **(L & S)**
- Writing and organising a short plan of an event **(R &W)**

Instructions and directions (L, S, R & W)
- Forming imperative sentences (Grammar)
- Reading and writing short instruction manuals **(R &W)**
- Writing a recipe/ procedure **(R &W)**
- Giving directions

Enquiring: (L, S, R & W)
- Open and closed ended questions **(Grammar)**
- Asking for information and giving information **(L & S)**
- Telephonic enquiry **(L & S)**
- Official enquiries through emails and letters **(R &W)**

Requesting: (L, S, R & W)
- Polite expressions
- Modal verbs and key phrases for requesting **(Grammar and vocab)**
- Official requests through emails and letters **(R &W)**

Comparing and contrasting: (L, S, R & W)
- Words and phrases used for comparison and contrast **(Vocab)**
- Comparing qualities/properties/quantities of people, places and objects **(L & S)**
- Composing comparison and contrast paragraphs **(R &W)**

Expressing opinion: (L, S, R & W)
- Language expressions used for expressing opinions **(Vocab)**
- Developing opinion based paragraphs **(R &W)**
- Discourse markers and linkers used in opinion based paragraphs **(R &W)**

Public Speaking: (L, S, R & W)
- Techniques and strategies required for public speaking **(L & S)**
- Developing and organising a short speech **(R &W)**
- Presentation skills required for public speaking **(L & S)**

Course Outcomes:

At the end of the course, students will be able to
1. Develop their confidence while giving introduction, describing a place, & giving directions. (3,4,5)
2. Use various functions of English like asking for & giving information**,** inviting people for events/occasions, & requesting people. (3,4,5)
3. Narrate the past experiences and events in speaking and wring (3,4,5)
4. Express their views and opinions logically and appropriately in spoken and written format. (3,4,5,6)
5. Deliver logically organized speeches and present them without hesitations. (3,4,5, 6)

Text Books:

1. Leo Jones; Functions of English, Published by: Cambridge University Press.
2. Leo Jones; Let’s Talk Level 1, 2, 3, Published by: Cambridge University Press.
3. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Intermediate (B1+)*; Published by: Cambridge University Press.

References:

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press,2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P.HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012
8. www.cambridgeenglish.org/in/
9. https://learnenglish.britishcouncil.org/en/english-grammar
10. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Description:

Physics Practical course is meant for making the students to gain practical knowledge to co relate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:

1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS:

{Out of 17 experiments any 12 experiments (minimum 10) must be performed in a semester}

1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR circuit.
3. Determination of radius of curvature of a curved surface - Newton's Rings.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
7. Thickness of a given wire - Wedge Method.
8. Dispersive power of prism – Spectrometer.
9. Frequency of the tuning fork - Melde's apparatus.
10. Determination of particle size using Laser.
11. Width of single slit - Diffraction due to Single Slit.
12. Torsional Pendulum.
13. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
14. Measurement of *e/m* of electron (Thomson's method)
15. Energy gap of a material of p-n junction.
16. Determination of Planck's constant.
17. Ferroelectric hysteresis (B-H Curve).

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.

Reference Books:

1. Physics Laboratory Manual.
2. Optics, A. Ghatak, 4^{th} Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4^{th} edition, McGraw-Hill Inc., 1981.
4. Engineering Mechanics, 2nd ed. — MK Harbola.
5. Introduction to Electrodynamics- David J Griffiths.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:

The laboratory facilitates the students to deal with electrical instruments, which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeter, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:

1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment's.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear..

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

DEMONSTRATIONS:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope. Study of passive components - resistors, capacitors and inductors.
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cut-out sections of transformer and DC & AC machines.
4. Demonstration of induction machine. Motor operation and generator operation of an induction machine driven at super-synchronous speed.
5. Wavelength of the spectral lines - Diffraction Grating.
6. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:

1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff's current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
7. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
8. Open-circuit and short-circuit test on a single-phase transformer.
9. Speed control of separately excited DC motor.
10. Wiring of a power distribution arrangement using single-phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

Course Outcomes:

Upon successful completion of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: 20CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To get hands-on practices with the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stacks, queues, and linked lists.

LIST OF EXPERIMENTS

1. a) Write a C program to swap the two numbers.
   b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:
   i. Marks in Maths >=65
   ii. Marks in Physics >=55
   iii. Marks in Chemistry>=50
   OR
   iv. Total in all three subject >=180
2. a) Write a C program to compute the factorial of a given number.
   b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.
3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
   b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.
4. a) Write a C program to find the series of prime numbers in the given range.
   b) Write a C program to generate Tribonacci numbers in the given range.
5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
   b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.
6. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the corresponding operation given below;
   a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication
7. Implement the following sorting techniques.
   a) Bubble sort b) Insertion sort c) Selection sort.
8. Implement the following searching techniques.
   a) Linear Search b) Binary Search
9. a) Write a program in C to find the frequency of characters in a string.
   b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.
10. a) Write a C program to get *N* elements in an array and sort it using Pointer.
    b) Write a C program to swap two integers using pass by reference.
    c) Write a C program to find the largest element using Dynamic Memory Allocation.

11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.
b) Write a C program to print all permutations of a given string using pointers.

12. a) Write a C program to add two distances in the inch-feet system using structures.
b) Write a C program to calculate difference between Two Time Periods (in *Hours, Minutes, Seconds* format) using structures.

13. Develop an application to match parenthesis of a given expression using Stack.

14. Develop an application to identify Palindrome string using Stack and Queue.

15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:

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

1. Understand fundamentals of C programming language and its constructs.
2. Design applications using functions, arrays, sorting and searching techniques.
3. Design and implement solutions using strings and pointers.
4. Design and develop solutions using structures and File processing.
5. Design and develop applications on stack, queue, and linked list depending on the problems to be solved.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

II Year I Semester

B. Tech II Year I Semester

20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the performance of firms under different market structures and Price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS 9 hours

Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS 9 hours

Production Function – Short-run and long- run production – Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) – Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING 9 hours

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination under various market conditions- Pricing objectives- Methods.

UNIT IV BASICS OF ACCOUNTING 9 hours

Uses of Accounting - Book Keeping Vs Accounting - Double Entry System - Accounting Principles - Classification of Accounts - Rules Of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 9 hours

Ratio Analysis - Liquidity, Leverage, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

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

1. Understand Engineering economics basic concepts,

2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

3. Compare different market structures and identify suitable market,

4. Demonstrate an understanding and analyzing the accounting statements, and

5. Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Books:

1. Case E. Karl & Ray C. Fair, “Principles of Economics”, Pearson Education, 8th Edition, 2007.
2. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009
3. Financial Statement Analysis, Khan and Jain, PHI, 2009
4. Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books:

1. Lipsey, R. G. & K. A. Chrystal , “Economics”, Oxford University Press, 11th Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. “Economics”, Tata McGraw-Hill 18th Edition, 2007.
3. Financial Management and Policy, Van Horne, James, C., Pearson, 2009.
4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech II Year I Semester

20MAT113 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101, 20MAT107**

Course Description:

Transform calculus is one of the important topics in the study of electronics and communication engineering because of its widespread applications. The course covers the applications of Laplace Transforms, Fourier and Z-Transforms relevant to communication engineering. The course also provides exposition to formation and solving of Partial Differential Equations and its applications.

Course Objectives:

This course enables students to

1. Apply Laplace transform and inverse Laplace transform to solve ordinary differential equations.
2. Apply Fourier transform and Inverse Fourier transform to solve sine and cosine transforms.
3. Introduce the concept of Z-transforms and its applications.
4. Formulate the Partial Differential Equations and solve the equations of first order.
5. Understand the concept of eigenvalues and eigen functions and solve the boundary value problems.

UNIT I LAPLACE TRANSFORMS 9 hours

Introduction - Applications to Differential Equations - Derivatives and Integrals of Laplace transforms, Convolutions - Integral Equation - Unit step and Impulse functions.

UNIT II FOURIER TRANSFORMS 9 hours

Introduction – Fourier Integral theorem (without proof) - Fourier Sine and Cosine Integrals - complex form of Fourier integrals, Fourier transforms - Properties - Inverse Fourier sine and cosine transforms Convolution theorem.

UNIT III Z – TRANSFORMS 9 hours

Introduction to Z-transform, Linearity property - Damping rule - Shifting rule - Initial and final value theorems, Inverse Z- transforms, convolution theorem - Evaluation of Inverse transforms - application to solve difference equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Introduction - Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions - Linear equations of first order - nonlinear equations of the first order

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Eigenvalues and Eigen functions - method of separation of variables - One dimensional wave equation - One dimensional heat equation.

Course Outcomes:

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

1. Apply Laplace transforms in solving ordinary differential equations relevant to the representations of communication systems.
2. Apply Fourier transforms and Inverse Fourier transforms for solving boundary value problems in the field of communications.

3. Apply Z-Transforms and Inverse Z- transforms for solving difference equations in communication system analysis.
4. Solve the linear and nonlinear partial differential equations of the first order.
5. Solve the one dimensional wave and heat boundary value problems.

Text Books:

1. George F. Simmons, "Differential Equations with Applications and Historical Notes", McGraw Hill Education (India) Private Limited, second Edition, 2014.

2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

2. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

3. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.

4. G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20ECE101 NETWORK THEORY

L	T	P	C
2	1	0	3

Pre-requisite **20EEE101**

Course Description:

This course is designed to provide basic understanding on electrical circuit analysis and synthesis. This also provides an exposure to coupled circuits, two port network analysis and filters.

Course Objectives:

This course enables students to

1. Understand the formulation of network equations, Network theorems and Graph theory.
2.Expose the students to the concepts of resonance in electrical circuit
3. Expose the students to the concepts of various types of Transient analysis of different electrical circuits with and without initial conditions using Laplace Transform.
4. Demonstrate relationship of two port network variables and connections.
5. Analyse and design passive network filter circuits, attenuators and equalizers

UNIT I NETWORK THEOREMS 9 hours

Network Theorems-Linearity and Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Milliman, Miller & Tellegan's Theorems. Source Transformation. Network Topology Formation of Incidence Matrix, Tieset and Cutset Matrix formation.

UNIT II RESONANCE 9 hours

Definition of 'quality factor Q' of inductor and capacitor, Series resonance: Impedance variation with frequency; universal resonance curves, Q factor and Bandwidth of the series resonant circuits, Parallel resonance (or anti-resonance): Impedance variation with frequency, Q factor and Bandwidth of parallel resonant circuits, Resonance between parallel RC and RL circuit.

UNIT III APPLICATION OF LAPLACE TRANSFORM TO ELECTRIC CIRCUITS 9 hours

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, Analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT IV TWO PORT NETWORKS 9 hours

Relationship of two port variables, Short circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, Relationship between parameter sets, Series, Cascade and Parallel connection of two port networks.

UNIT V FILTER DESIGN 9 hours

Introduction, the Neper & decibel, Properties of symmetricalT and πnetworks, the Filter fundamentals; pass and stop bands, Behavior of characteristic impedance, Variation of characteristic impedance over the pass band, The constant – k filters T and π section. Attenuators: T-Type, Pi-Type, Bridged T-Type. Equalizers: Inverse impedances. Series and Shunt equalizers, T-equalizers and Bridged T-equalizers.

Course Outcomes:

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

1. Apply various theorems to solve the networks.
2. Analyse the series and parallel resonance circuits.
3. Analyze the response of RL, RC and RLC circuits with different inputs.
4. Solve two port networks analysis.
5. Design symmetrical and unsymmetrical passive filters.

Text Books:

1. Sudhakar, A and Shyammohan S. Palli., "Circuits and Networks, Analysis and Synthesis", McGraw-Hill Education India Pvt. Ltd, 5th Edition, 2010
2. Van Valkenburg, "Network Analysis", Pearson Education, 3rd Edition, 2011.

Reference Books:

1. M.E. Van Valkenburg, "Analog Filter Design", Oxford University Press, 2010.

2. Franklin F. Kuo, "Network Analysis and synthesis", Wiley India Pvt Ltd, 2nd Edition, 2006

3. Chenna Venkatesh, K and Ganesh Rao, D., "Network Analysis- A Simplified Approach", Elsevier, 2nd Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20ECE102 DIGITAL SYSTEM DESIGN

L	T	P	C
2	1	0	3

Pre-requisite **20EEE101**

Course Description:

This course provides a modern introduction to logic design and the basic building blocks used in digital systems. It starts with a discussion of basics related to logic simplification using Boolean algebra and other minimization techniques. Then, a brief discussion of combinational logic design, sequential logic design, logic families and VLSI Design flow have been considered.

Course Objectives:

This course enables students to

1. Familiarize fundamental principles of digital system design.
2. Understand and design the combinational logic circuits.
3. Understand and design sequential logic circuits.
4. Summarize digital integrated circuits, different logic families, semiconductor memories, and Programmable logic devices.
5. Understand the VLSI Design flow and the IEEE Standard 1076 Hardware Description Language (VHDL).

UNIT I LOGIC SIMPLICATION 9 hours

Binary Systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Compliments, Signed Binary Numbers, Binary Codes. Boolean Algebra: Basic Definitions, Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, SOP & POS forms, Canonical forms, Karnaugh maps up to 5 variables, Other Logic Operations, Logic Gates: Digital Logic Gates, NAND and NOR Implementation Integrated Circuits.

UNIT II COMBINATIONAL LOGIC DESIGN 9 hours

Combinational Circuits: Analysis Procedure, Design Procedure, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Decoder, Encoder, Multiplexers.

Combinational Logic Design: BCD to Seven Segment Decoder, Barrel Shifter and ALU

UNIT III SEQUENTIAL LOGIC DESIGN 9 hours

Sequential Logic Design: Clock Triggering, Basics of Latch and Flip Flops, building blocks like S-R, JK, D, T and Master-Slave JK FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM Designing Synchronous Circuits: Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

UNIT IV LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES 9 hours

Logic Families and Semiconductor Memories: Digital Integrated Circuits, Different logic families (RTL, DTL, TTL), and their specifications, Noise margin, Propagation delay, fan-in, fan-out, TTL based NAND gate, Totem Pole TTL, CMOS logic families Memory Hierarchy & different types of memories: Analog-to-Digital and Digital-to-Analog Converters Programmable logic devices: Programmable Logic Array, Programmable Array Logic, and FPGA.

UNIT V VLSI DESIGN FLOW 9 hours

VLSI Design flow: Y-chart, Design entry: Schematic, HDL, Different modelling styles in VHDL: Structural, Data Flow and Behavioural Data types and objects, Codes for combinational (Adder/Subtractor/Multiplexers) and sequential circuits (Flip Flops/Counters), Synthesis and Simulation.

Course Outcomes:

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

1. Apply Boolean algebra and K-Map to simplify and design various logical circuits in digital electronics.
2. Design and analyse various combinational logic circuits.
3. Design and analyse various sequential logic circuits.
4. Understand different logic families, design and implementation of digital circuits using programmable logic devices.
5. Develop VHDL code to simulate and synthesize combinational and sequential logic circuits.

Text Book(s)

1. Morris Mano, M and Michael D. Ciletti, "Digital Design" Pearson Education Ltd., 5th edition, 2013.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.

Reference Books

1. Hall, D V, "Digital Circuits and Systems", Tata McGraw Hill, 1989.

2. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", Prentice Hall of India Pvt. Ltd., 2nd edition, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20ECE103 ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20EEE101**

Course Description:

This course provides an overview of Semiconductor Physics and Carrier Transport Phenomenon. It illustrates semiconductor PN junction diodes, & its small signal switching models, Bipolar junction Transistors (BJT) & Eber's Moll model, MOS Transistors and their characteristics.

Course Objectives:

This course enables students to

1. Acquire fundamental knowledge and expose to the field of semiconductor theory and devices and their applications.
2. Introduce different types of semiconductor devices.
3. Describe operation and characteristics of Bipolar Junction Transistor & Field Effect Transistor.
4. Explain application of diodes as rectifiers, clippers, clampers and regulators.
5. Analyze the various biasing circuits using BJTs & FETs.

UNIT I FUNDAMENTALS OF SEMICONDUCTORS 9 hours

Review of Band Theory of solids, intrinsic semiconductors, Direct and Indirect band-gap semiconductors, carrier concentration in semiconductor, Drift and Diffusion current, Hall effect, mobility and resistivity Generation and Recombination of electrons and holes. Thermal equilibrium, Doped semiconductors n and p types, Fermi level and carrier concentrations of n and p type semiconductors. Carrier mobility and conductivity, diffusion, Continuity equation

UNIT II SEMICONDUCTOR DIODES 9 hours

Band structure of PN junction, current components, Quantitative theory of PN diode, Volt-ampere characteristics and its temperature dependence, Narrow-base diode, Transition and diffusion capacitance of P-N junction diodes, Breakdown of junctions on reverse bias, Zener and Avalanche breakdowns, Tunnel diode and its V-I characteristics, The principles of photo diode, photo transistor, LED & LCD.

UNIT III TRANSISTORS 9 hours

PNP and NPN junction transistors, Characteristics of the current flow across the base regions, Minority and majority carrier profiles, Transistor as a device in CB, CE and CC configurations, and their characteristics, Eber's-Moll Model of BJT. JFET- Structure, operation, characteristics and biasing - MOSFET- Structure, operation, MOS capacitor, characteristics and biasing – Types of MOSFET

UNIT IV APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

Diode circuits: half wave, full wave and bridge rectifiers - filters, voltage multiplier, clipper circuits, clamper circuits, Voltage regulator circuit using Zener diode.

Transistor amplifiers: BJT and MOS amplifiers

UNIT V LOW FREQUENCY ANALYSIS OF TRANSISTOR AMPLIFIERS 9 hours

Transistor as a two-port device and its Hybrid Model: Models for CB, CE, CC configurations and their Interrelationship, Small signal analysis of BJT amplifiers, analysis of low frequency transistor model, estimation of voltage gain, current gain, input resistance and output resistance. Small Signal operation and model of MOSFET, Single stage MOSFET Amplifiers

Course Outcomes:

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

1. Understand the various charge carrier transport mechanisms in semiconductor materials and devices.
2. Describe basic operation and characteristics of various semiconductor diodes.
3. Discuss basic operation and characteristics of various semiconductor transistors.
4. Describe the various applications of diodes and transistor circuits.
5. Analyse low-frequency and high-frequency models of BJTs and FETs.
6.

Text Books:

1. Adel S Sedra, Kenneth C Smith and Arun N Chandorkar, "Microelectronic Circuits – Theory and Applications", Oxford University Press, 7th edition, 2017.

2. Robert L Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson India Education Services Pvt. Ltd., 11th edition, 2015.

Reference Books:

1. Donald A Neamen, "Electronic Circuits – Analysis and Design", McGraw Hill Education, 3rd edition, 2006.

2. Albert Malvino and David Bates, Electronic Principles, McGraw Hill Education, 11th edition, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20ECE201 NETWORKS AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20EEE201**

Course Description:

This course is designed to help the students to verify various network theorems, study transient analysis of RLC circuits. Also design and analyse resonance circuits, two port network parameters and filter circuits respectively.

Course Objectives:

This course enables students to

1. Understand various network theorems.
2. Design circuits to verify various Network theorems: Superposition, Thevenin's, Norton's, Millman's theonem, Miller's theorem, Reciprocity Theorem and Maximum Power Transfer Theorem.
3. Design and verify series and parallel resonance circuits.
4. Design and analyze the two port networks.
5. Design filters with cut off frequencies.

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Law.
   B) Apply Mesh and Node Analysis Techniques for Solving Electrical Circuits.

2. Verification of Superposition and Reciprocity Theorem.

3. Verification of Thevenin's and Norton Theorem.
   B) Verification Maximum Power Transfer Theorem.

4. Verification of Miller Theorem and Millman's Theorem

5. Verification of Tell Egan's Theorem

6. Design A Series RLC Circuit. Plot Frequency Response and Find Resonance Frequency, Bandwidth, Q-Factor.

7. Design a Parallel RLC Circuit. Plot Frequency Response and Find Resonance Frequency, Bandwidth, Q-Factor.

8. Design A RC Time Constant for A Given RC Circuit.
   B) Design A RL Time Constant for A Given RL Circuit.

9. :sign and analyse (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases:
   i) ζ =1 (critically damped system)
   ii) ζ =1 (critically damped system)
   iii) ζ<1 (Under damped system)

   Choose appropriate values of R, L, and C to obtain each of above cases one at a time.

10. Design and analyze Z, Y parameters of two-port network.

11. :sign and analyze ABCD & h parameters of two-port network.

12. :sign a Constant-K, T and π section of low pass and high pass filters for the following cutoff frequency.
   i)50 Hz
   ii)30 kHz

Course Outcomes:

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

1. Apply various theorems to solve the networks.
2. Design and verify series and parallel resonance circuits.
3. Analyse responses of RL, RC and RLC circuits with different inputs.
4. Design and analyse two port networks using Z, Y, ABCD and h parameters.
5. Design filters for various cutoff frequencies

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

20ECE202 DIGITAL SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20EEE201**

Course Description:

This course is designed to help the students to understand the basics of digital system design and its implementation in Programmable logic devices using VHDL (VHSIC Hardware Description Language). Also, to understand the FPGA based implementation for design verification. Further, the implementation of different combinational and sequential logic designs using digital trainer kit will also be taken into consideration using ICs.

Course Objectives:

This course enables students to

1. Understand designing methodologies for combinational and sequential logic circuits.
2. Study and use of VHDL code for desired system modeling and simulation.
3. Design and verify combinational and sequential circuits using VHDL.
4. Implement digital systems using programmable logic devices (FPGAs)
5. Verify different combinational and sequential logic circuit functions using IC's.

LIST OF EXPERIMENTS

PART A: EXPERIMENT USING 74 xx ICs

1. Logic gates using 74xx ICs
   a) Verification of truth table of basic logic gates.
   b) Realization of basic Logic gates using Universal Logic Gates (NAND/NOR).
   c) Implementation of different Boolean functions

2. Binary Adders using 74 xx ICs
   a) Half Adder
   b) Full Adder

3. Binary Subtractors using 74 xx ICs
   a) Half Subtractor
   b) Full Subtractor

4. Decoder and Encoder Implementation
   a) 3:8 decoder using IC 74138
   b) 8:3 encoder using IC 74x148

5. Multiplexer and Demultiplexer
   a) Realization of 8:1 Multiplexers using IC 74x151.
   b) Realization of 2:4 Demultiplexer using IC 74139.

6. Latches and Flip Flops
   a) Realization of D Latch using IC 7474.
   b) Implementation of Master Slave JK Flip-Flop using IC 7476.

7. Realization of 4-bit comparators using IC 74x85.

8. Analysis of Decade counters using IC 74x90.

9. Implementation of universal shift registers using IC 74x194.

PART B: EXPERIMENTS USING XILINX TOOL

10. Logic gates using Verilog HDL
   a) Realization of basic logic gates.
   b) Implementation of Universal logic gates (NAND/NOR)

11. Binary Half/Full Adder using VHDL
   a) Gate Level Modeling.
   b) Data Flow Modeling.
   c) Behavioural Modeling.

12. Binary Half/Full subtractor using VHDL
   a) Gate Level Modeling.
   b) Data Flow Modeling.
   c) Behavioural Modeling.

13. Realization of Full adder (substractor) using half adder (subtractor) in Verilog HDL using Data Flow/Behavioural Modeling.

14. Design and realization of 3:8 Decoder in VHDL using Data Flow Modeling.

15. Design and realization 8:1 Multiplexer circuit using Structural Modeling and test bench.

16. Realization of SR and D Latch in Verilog HDL using Behavioural Modeling and test bench.

17. Realization of J K and D Flip Flop using Behavioural Modeling and test bench.

18. Design and Implementation of adder/subtractor circuits on FPGA board using Verilog HDL.

Course Outcomes:

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

1. Understand the functionality of digital systems.
2. Analyze and synthesize the digital modules at different abstraction levels.
3. Design and simulate various combinational circuits using VHDL.
4. Design and simulate various sequential circuits using VHDL.
5. Interpret the specifications of programmable logic devices and implement different logic functionality on FPGA kit.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

20ECE203 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20EEE201**

Course Description:

This course is designed to help the students to understand the characteristics and frequency response of semiconductor devices like p-n junctions, Zener diodes, BJTs, JFETs and MOSFET respectively.

Course Objectives:

This course enables students to

1. Understand the I-V characteristics of p-n junction, Zener diode, JFET and MOSFET
2. Learn the applications of p-n junction diode and Zener diode
3. Understand frequency response of CE and CC amplifiers
4. Simulate and understand the forward and reverse bias I-V characteristics of p-n junction diode, and Zener diode as a voltage regulator (Line and load) using Multisim.
5. Simulate the frequency response of CE and CC amplifiers using Multisim.

LIST OF EXPERIMENTS

Part-A (Hardware)

1. Forward and reverse bias I-V characteristics of p-n junction diode
2. Zener diode I-V characteristics of Zener diode.
3. Zener diode as a voltage regulator (Line and load).
4. Half and full wave rectifiers with and without RC filter.
5. Clipper and clamper circuits design and analysis.
6. Input and output characteristics of BJT in CB, CE, CC configuration.
7. JFET drain and transfer characteristics.
8. FET amplifier based on CS configuration.
9. MOSFET drain and transfer characteristics
10. Frequency response of CE and CC amplifier.

Part-B (Simulation)

11. Forward and reverse bias I-V characteristics of p-n junction diode using Multisim.
12. Zener diode I -V characteristics of Zener diode using Multisim.
13. Zener diode as a voltage regulator (Line and load) using Multisim.
14. Simulation of input and output characteristics of transistor in CB, CE and CC configuration using Multisim
15. Simulation of frequency response of CE and CC amplifiers using Multisim.

Course Outcomes:

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

1. Analyze the characteristics of electronic devices such as p-n junctions, Zener diodes, BJT, JFETs and MOSFET
2. Analyze and design simple circuits like half-wave, full-wave rectifiers, clipper and clamping circuits.
3. Analyse FET amplifier based on CS configuration
4. Measure frequency response of CE and CC amplifier.
5. Design and analyze of frequency response of CE and CC amplifiers using Multisim

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech. II Year I Semester

20HUM901 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite **NIL**

Course Description:

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state.

Course Objectives:

The course is intended to:

1. To know about Indian constitution;
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I INTRODUCTION **6 hours**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6 hours**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6 hours**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6 hours**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY **6 hours**

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Course Outcomes:

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

1. Understand the functions of the Indian government; and

2. Understand and abide the rules of the Indian constitution.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi..
2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
3 Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
4 K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

Reference Books:

1. **S**harma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2 U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

II Year II Semester

B. Tech II Year II Semester

20MAT109 PROBABILITY THEORY AND STOCHASTIC PROCESS

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101, 20MAT107**

Course Description:

Probability, conditional probability, Bayes theorem, random variables, mathematical expectation, discrete and continuous distributions, joint distributions, random sequence, law of large numbers and stochastic processes.

Course Objectives:

This course enables students to

1. Introduce the probability concepts through sets, and apply the joint and conditional probability.
2. Study the probability distributions and their importance.
3. Solve the problems related to multivariate probability distributions.
4. Analyze the concept of random sequence and formulate joint distributions by using transformation of random variables.
5. Apply the random processes to evolving in time or space analysis and applications to the signal processing in the communication system.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 hours

Probability – Classical and introduced through sets, joint and conditional probability, independent events, combined experiments and Bernoulli trials.

UNIT II ONE DIMENSIONAL RANDOM VARIABLE 9 hours

Random variable concept, distribution function, density function, Gaussian, binomial, Poisson, uniform, exponential and Rayleigh distributions. Expected value of a random variable, moments, characteristic function and moment generating function.

UNIT III MULTIPLE RANDOM VARIABLES 9 hours

Vector random variables, joint distribution function, joint density function and its properties, conditional distribution and conditional density functions. Statistical independence, joint moments, joint characteristic function.

UNIT IV TRANSFORMATION OF RANDOM VARIABLES AND RANDOM SEQUENCES 9 hours

Jointly Gaussian random variables. Transformation of one and multiple random variables. Chebychev's inequality. Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT V RANDOM PROCESSES 9 hours

Random process, stationarity and independence, correlation functions, measurement of correlation functions, Gaussian random processes. Power spectrum density and its properties. Linear system fundamentals and random signal response of linear systems.

Course Outcomes:

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

1. Understand the concepts of Probability and their importance.
2. Study the one-dimensional random variable and Univariate probability distributions.
3. Evaluate the joint probability distributions and its applications in engineering problems.
4. Analyze characteristics of random sequences.
5. Apply the random processes and its applications to the signal processing in the communication system.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th edition, 2001.

Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," 3rd edition, Pearson Education.

2. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," 4th edition, McGraw-Hill.

3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International

4. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year II Semester

20ECE104 CONTROL SYSTEMS ENGINEERING

L	T	P	C
2	1	0	3

Pre-requisite **20ECE101**

Course Description:
compensator/controller design as per the system performance requirements. It covers the concept of system modelling using first principle approach, system representation using transfer function, state space, block diagram and signal flow graph, system analysis and compensator design in time domain (using Routh-Hurwitz & Root locus method) and in frequency domain (using Bode, Polar and Nyquist plots). Also, the course provides a foundation of modern control theory.

Course Objectives:
This course enables students to

1. Gain knowledge of physical systems and processes, which can be utilized for their mathematical modelling, analysis and control.
2. Understand standard test signals, transient and steady-state response, error constants and key performance specifications in time and frequency domain.
3. Understand various control system stability analysis and design approaches.
4. Understand the frequency response analysis of control system.
5. Develop a basic foundation of modern control theory.

UNIT I CONTROL SYSTEMS - MODELLING AND REPRESENTATION 9 hours
Introduction to Control Systems: Basic Concepts of Control Systems, Open loop and closed loop systems, Practical examples, Mathematical modelling of physical systems, Introduction to control system components: Actuators, Sensors, Transducers, Servo Mechanism/Tracking System, Representation of linear systems using differential equations and transfer functions. Block diagram and its reduction rules, Signal flow graph and Masson's gain formula.

UNIT II TIME DOMAIN ANALYSIS 9 hours
Transient and steady state response of feedback control systems, Time domain specifications, Location of poles on s-plane and the transient response, Time response of first order systems, Time Response of second order systems, Steady-state errors and error constants, Performance indices (IAE and ISE).

UNIT III STABILITY ANALYSIS AND CONTROLLER DESIGN 9 hours
Concept of system stability, Routh-Hurwitz stability criterion, Relative stability, Concept of root locus and its procedure. Introduction to compensator and controllers, Lead and lag compensator, P, PI and PID control actions

UNIT IV FREQUENCY DOMAIN ANALYSIS 9 hours
Bode plot, Frequency-domain specifications, Correlation between time and frequency domain specifications, Concept of stability and relative stability, All Pass and Minimum- Phase Systems, Non-minimum phase system, Polar plots, Nyquist plots, Nyquist stability criterion.

UNIT V MODERN CONTROL THEORY 9 hours

Introduction to state variables and state space models of linear systems, State transition matrix, Solution of state equations (homogenous and non-homogenous), Concept of Controllability & Observability

Course Outcomes:

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

1. Apply the knowledge of basic sciences to represent a variety of physical systems using mathematical and graphical models.
2. Describe the system behaviour in terms of various performance parameters and apply controller design methodologies to study and improve the dynamic behaviour of the system.
3. Analyse control systems to investigate the stability and relative stability.
4. Analyse the frequency response of control systems.
5. Analyse control systems using modern control theory.

Text Books:

1. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Prentice Hall, 12th edition,2011.

2. Nagrath, I J and Gopal, M. "Control System Engineering", New Age International Pvt. Ltd., 6th edition, 2017.

Reference Books:

1. Kuo, B.C. and Golnaraghi, F. "Automatic Control System", John Wiley and Son's, 9th edition,2010.

2. Ogata, K. "Modern Control Engineering", Prentice Hall, 5th edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year II Semester

20ECE105 PRINCIPLES OF SIGNALS AND SYSTEMS

L	T	P	C
2	1	0	3

Pre-requisite **20MAT101**

Course Description:

The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The course covers theory and methods to develop expertise in time-domain as well as in frequency domain approaches to the investigation of continuous and discrete systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time.

Course Objectives:

This course enables students to

1. Study the mathematical description and representation of discrete and continuous signals and systems.
2. Obtain the response of an LTI system and convert a continuous-time signal to the discrete-time using sampling.
3. Study the frequency domain analysis of continuous time and discreate-time signals and systems using Fourier transform.
4. Analyze the continuous-time systems using Laplace transform.
5. Analyze the discrete-time systems using z-transform.

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS 9 hours

Signals – Continuous-time (CT) & Discrete-Time (DT) signals –Basic CT & DT Signals, Signal Operations, Representation of signals in terms of impulse function, Classification of CT &DT Signals: - Energy and power signals, Even and Odd signals, Periodic and Aperiodic signals, — Systems – Classifications of CT & DT systems: – static & dynamic, causal & non-causal, linear & non-linear, time variant & time invariant, and stable & unstable systems. Application of signal and systems in various field of engineering.

UNIT II LINEAR TIME INVARIANT (LTI) SYSTEMS 9 hours

LTI Systems, Properties of LTI systems – causality and stability. Convolution and its properties, Convolution Integral of CT-LTI systems, Convolution sum of DT-LTI systems (tabular and graphical methods), Unit impulse response and unit step response of LTI systems. The Sampling theorem and its implications- Spectra of sampled signals. Reconstruction: Aliasing and its effects, Nyquist rate and Nyquist interval.

UNIT III FOURIER ANALYSIS FOR PERIODIC AND APERIODIC SIGNALS 9 hours

Fourier series representation of a continuous time periodic signal: Trigonometric and Complex exponential and their relation. Continuous Time Fourier Transform (CTFT), magnitude and phase response, properties of CTFT, Fourier series representation of a discrete time periodic signal: Discrete Fourier series (DFS), Th Discrete-Time Fourier Transform (DTFT) and its properties.

UNIT IV ANALYSIS OF CONTINUOUS TIME SIGNAL AND SYSTEMS USING LAPLACE TRANSFORM 9 hours

The Laplace Transform of continuous time signals and systems, relation between Laplace and Fourier transform, region of convergence, poles and zeros of system. Laplace transform of some common signals, properties of Laplace transform, properties of region of convergence. Inverse Laplace transform, Laplace domain analysis of continuous time LTI system.

UNIT V ANALYSIS OF DISCRETE TIME SIGNAL AND SYSTEMS USING Z TRANSFORM 9 hours

The z-Transform of discrete time signals and systems, region of convergence, z-transform of some common sequences, properties of Z transform, properties of region of convergence. Inverse z-transform: distinct pole and repeated-pole system. Z - domain analysis for discrete-time systems, system function analysis of discrete-time LTI.

Course Outcomes:

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

1. Understand the fundamentals and classifications of signals & systems.
2. Analyse the LTI systems using convolution and concept of sampling.
3. Represent periodic and aperiodic signals in the frequency domain using Fourier transforms.
4. Analyse the continuous time system behaviour using the Laplace Transform.
5. Analyse the discrete time system behaviour using the z-Transform.

Text Books:

1. Alan V Oppenheim, Alan S Willsky and S Hamid Nawab, “Signals and Systems”, PHI Learning Private Limited, 2nd edition, 2010.

2. Douglas K. Lindner, “Introduction to Signals and Systems”, McGraw Hill International ISE edition, 1999.

Reference Books:

1. Haykin. S and Barry Van Veen, “Signals and Systems", John Wiley and Sons, 2nd edition, 2012.

2. Lathi, B. P, “Signal Processing and Linear Systems”, Oxford University Press, 1998.

3. Hsu.H.P and Rakesh Ranjan, “Signals and Systems- Schaums‘s Outlines”, Tata McGraw Hill, 2nd edition, 2010.

4. Samir S. Soliman and Mandyam Dhati Srinath, “Continuous and Discrete Signals and Systems”, Prentice-Hall International, 2nd edition, 2011.

5. Luis F. Chaparro, “Signals and Systems Using MATLAB”, Academic Press-An Imprint of Elsevier, 1st edition, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year II Semester

20ECE106 ANALOG CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103**

Course Description:
This course provides a basic knowledge on differential amplifier, designing feedback amplifier, oscillator circuits, Op-Amp applications and special function IC's.

Course Objectives:
This course enables students to
1. Study the basics of differential amplifiers.
2. Understand the basics of feedback amplifiers and oscillators.
3. Realize the basic operations and configurations of operational amplifiers.
4. Design and develop the important applications of operational amplifier
5. Study special function ICs and its applications.

UNIT I DIFFERENTIAL AND POWER AMPLIFIERS 9 hours

Differential amplifiers: Operation of BJT and MOS differential amplifiers and its small signal equivalent circuit analysis, MOS differential amplifier with active load, Basic MOS current mirror circuits, MOS current mirror circuits with improved performance. Steering circuits.
Power amplifiers: Class A, Class B, Class AB and Class C, estimation of power efficiency.

UNIT II FEEDBACK AMPLIFIERS AND OSCILLATORS 9 hours
Feedback amplifiers: Basics of feedback, positive and negative feedback. Properties of negative feedback, Feedback topologies, series-shunt, shunt-series, series-series, shunt-shunt. Analysis of feedback voltage amplifiers.
Oscillators: Barkhausen criteria, RC oscillators: Phase-shift and Wien bridge oscillators, LC oscillators: Hartley and Colpitts oscillators, Crystal oscillator.

UNIT III OPERATIONAL AMPLIFIERS 9 hours
Block diagram and symbol of op-amp, Ideal op-amp, differential gain, common-mode gain and CMRR, Inverting and non-inverting configurations, Practical op-amp: Input offset voltage, input bias current, input offset current, slew rate. Summing and difference amplifiers, basic and practical integrators and basic and practical differentiators, voltage follower.

UNIT IV APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours
Log and antilog amplifiers, Comparators, Schmitt trigger and derivation of the hysteresis voltage.
Active filters: low-pass, high-pass, band-pass, band-stop and all-pass filters. Precision rectifiers: Half-wave and full wave. Instrumentation amplifiers

UNIT V SPECIAL FUNCTION ICs 9 hours
IC Voltage regulators –Linear regulators and switching regulators. Fixed (78XX and 79XX) and adjustable voltage regulators (IC 723). - Monolithic switching regulator, 555 Timer: Functional block diagram, astable and monostable mode of operations, Voltage controlled oscillator (VCO), Phase locked loop (PLL), Monolithic PLL IC 565, applications of PLL

Course Outcomes:

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

1. Understand the operation of differential and power amplifier.
2. Design the feedback amplifiers and oscillator circuits.
3. Analyze the characteristics of operational amplifier
4. Design of operational amplifier based circuits for various applications.
5. Analyse the applications of special function ICs.

Text Books:

1. Sedra, A. S. and Smith, K. C "Micro Electronic Circuits", Oxford University Press, 6th edition, 2011.

2. Ramakant, A. and Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th edition, 2015.

Reference Books:

1. Roy Choudhry, D and Shail B. Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 4th edition, 2018.

2. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th edition, 2008.

3. Millman and Halkias, "Integrated Electronics", McGraw Hill Education, 2nd edition, 2017.

4. Razavi, "Fundamentals of Microelectronics", John Wiley, 2nd edition, 2013.

5. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", Pearson Education, 11th edition, 2015.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year II Semester

20ECE107 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102**

Course Description:

This course provides the detailed review of 8086 microprocessor, its architecture, addressing modes, instruction set, bus structure and I/O Interfacing. It also describes the 8051 microcontroller, and ARM microcontroller with deeper insights on instruction sets, addressing modes, interfacing, and programming for real-life applications.

Course Objectives:

This course enables students to

1. Understand the 8086-microprocessorarchitecture and its programming
2. Analyze 8086 microprocessor interfacing with various peripherals.
3. Understand the 8051-microcontroller and its programming.
4. Understand the RISC architecture of ARM microcontroller
5. Develop program for applications involving 8051/ARM microcontrollers

UNIT I 8086 MICROPROCESSORS 9 hours

Introduction to 8086 – 8086 Microprocessor architecture – Instruction set - Addressing modes- Assembler directives – Assembly language programming, Introduction to advanced processors.

UNIT II INTERFACING WITH 8086 9 hours

Memory interfacing- Parallel communication interface- Timer – Keyboard /display controller – Interrupt controller – DMA controller- Assembly language programming related to the above interfacing

UNIT III 8051 MICROCONTROLLERS 9 hours

Architecture of 8051 – Special Function Registers (SFRs) – Instruction set – Addressing modes – Assembly language programming involving I/O Ports –8051Timers – Serial Ports – Interrupts.

UNIT IV ARM MICROCONTROLLER 9 hours

The RISC design philosophy- ARM Architecture fundamentals- ARM Instruction Set - Thumb Instruction set – ARM Assembly Language Programming – C programming – Optimizing ARM Assembly Code.

UNIT V APPLICATION PROGRAMMING 9 hours

Introduction to Proteus simulator, 8051/ARM based Interfacing design and programming for applications such as: Keypad – LCD display - Seven segment display - Digital clock – Stepper motor control – ADC/DAC– Traffic light control – Use serial communication facility to send/receive messages – Use interrupt facility to monitor and service real-time events.

Course Outcomes:

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

1. Understand the 8086-microprocessorarchitecture, instructions set and programming
2. Analyse 8086 microprocessor interfacing with various peripherals.
3. Understand the 8051-microcontroller, instruction set, addressing modes and programming
4. Understand the RISC architecture fundamentals and programming of ARM microcontroller
5. Develop program for applications involving 8051/ARM microcontrollers

Text Books:

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", McGraw Hill Education, 2012

2. Mohamed Ali Mazidi, Janice Gillispie Mazidi and RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2nd edition, , 2011.

Reference Books:

1. Andrew N. Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide: Designing and Optimizing System Software" Morgan Kaufmann Publishers, 2004

2. Senthil Kumar. N, Saravanan. M and Jeevananthan. S, "Microprocessors and Microcontrollers", Oxford University Press, 2nd edition. 2016.

3. Kenneth J. Ayala, "The 8086 Microprocessor- Programming & Interfacing The PC", Cenage Learning, 1st edition, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year II Semester

20ECE204 SIMULATION AND CONTROL LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE101**

Course Description:
This course helps the students to analyze in depth the signals and systems in time, frequency and z - domains respectively. It is expected that student should acquire familiarity with mathematical representation of signals and systems. This course also provides simulation of signals and exposure to control systems using MATLAB and Simulink.

Course Objectives:
This course enables students to

1. Understand the representation of continuous and discrete time signals and systems in time domain.
2. Study and analyse frequency domain versions of different systems along with their Characteristics.
3. Know the concepts of Laplace transform and z-Transform, analysis of properties and characterization of LTI systems.
4. Study the error compensation by numerical analysis using MATLAB and understanding the effect of PID Controller on system response.
5. Analyse stability of a given Linear Time Invariant System, various control systems using MATLAB.

LIST OF EXPERIMENTS

1. Introduction to MATLAB and basic Operations on Matrices.
2. Write a program to generate various signals and sequences and perform operations like addition, multiplication, scaling, shifting, and folding.
3. Write a program to verify the linearity and time-variant property of a systems.
4. Write a program to find the convolution of Continuous Time and Discrete Time Signals.
5. Write a MATLAB program to implement Fourier series.
6. Write a MATLAB program to implement Continuous Time Fourier Transform (CTFT) and Discrete Time Fourier Transform (DTFT).
7. Write a MATLAB program to Implement Laplace Transform and z-Transform.
8. Write a program to verify and observe Sampling Theorem using MATLAB.
9. Modelling of a DC motor and validation of its characteristics using Simulink
10. To find the effect of P, PI and PID controller on first order and second order system.
11. Stability Analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant System.
12. State space model for classical transfer function using MATLAB.
13. To Study the Frequency Response of Analog Filters Using MATLAB.
14. Write a program to do the analysis of sampling rate conversion system
(a) Interpolation by a factor L
(b) Decimation by a factor M
(c) Sampling rate conversion by a rational factor (L/M)

15. Write a program to find out DFT of a sequence.

16. Write a program to obtain the magnitude and phase response of finite duration DT sequences using N-point FFT algorithm.

Course Outcomes:

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

1. Analyze the properties of different types of signals and systems in time domain.
2. Understand the frequency domain analysis of different systems along with their Characteristics.
3. Apply the Laplace transforms and Z transform for analysing the LTI system and also verify the sampling theorem.
4. Design and verify PID Controller, and effect of feedback on first order and second order systems.
5. Analyze stability of a given LTI system and various control systems using MATLAB.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

20ECE205 ANALOG CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE103**

Course Description:
This course provides hands on experience to students on design and implementation various circuits using operational amplifiers 741 and MULTISIM.

Course Objectives:
This course enables students to
1. Gain hands on experience in designing electronic circuits
2. Learn simulation software used in circuit design
3. Learn the fundamental principles of amplifier circuits
4. Differentiate feedback amplifiers and oscillators.
5. Differentiate the operation of various multi-vibrators.

LIST OF EXPERIMENTS
Design and Implementation of the following Circuits using Hardware and Multisim
1. Study of voltage feedback amplifiers and trans-conductance amplifiers
2. Design and implementation of differential and summing amplifier using op-amps
3. Design and test inverting and non-inverting amplifiers using op-amps
4. Measurement of input offset voltage, input bias current and input offset current, slew rate of op-amp
5. Design and test RC phase-shift oscillator and Wien bridge oscillator
6. Design and test Hartley oscillator and Colpitts oscillator
7. Design and implementation of active LPF, HPF and band-pass filter
8. Design and test integrator and differentiator circuits using op-amp
9. Measurement of gain of instrumentation amplifier using op-amp
10. Design and test astable and monostable multivibrators using 555 timers
11. Voltage regulator using IC 78XX, IC 79XX, IC 723
12. Comparator and Schmitt trigger circuit using op-amp

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Measure input offset voltage, slew rate of op-amp
2. Design and implement various applications of op-amp
3. Design and implement astable and monostable multivibrator using 555 timers
4. Implement Fixed and adjustable voltage regulator
5. Implement above circuits using MULTISIM Tool

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

20ECE206 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE102, 20ECE103**

Course Description:

This laboratory course is designed to help the students understand and practise the assembly/C language programming of 8086-microprocessor, 8051 and ARM-microcontrollers. Further this course provides hands on experience on designing and interfacing of various peripherals with the 8086-microprocessor, 8051 and ARM-microcontrollers.

Course Objectives:

This course enables students to

1. Gain hands on experience in writing assembly language programs for 8086- microprocessor.
2. Learn interface various peripheral chips to 8086-microprocessor.
3. Learn the basic operation of various Peripherals
4. Gain hands on experience in writing assembly language programs for 8051-microcontroller.
5. Learn about designing and implementing 8051 and ARM microcontroller-based systems.

LIST OF EXPERIMENTS

8086 Microprocessor Experiments:

1. Assembly Language Program to perform Arithmetic operations
2. Assembly Language Program to perform array operation- Searching and Sorting
3. Assembly Language Program to perform String operations - Move block, Reverse string, String comparison, Length of string
4. Assembly Language Program to perform Code conversions–Hexadecimal to Decimal and vice-versa, Grey code to Binary and vice-versa
5. Reading and Writing data using parallel ports of 8255 PPI.
6. Interfacing of 8279 Keyboard / Display controller to display a string message

8051 Microcontroller Experiments:

7. Assembly Language Program to perform Arithmetic operations
8. Assembly Language Program for Largest/Smallest of an Array
9. Interfacing of Traffic Light Controller with 8051microcontroller.
10. Interfacing of ADC/DAC

ARM Microcontroller Experiments:

11. Interfacing of Stepper Motor for running in forward and reverse direction
12. Interfacing of LCD to display Digital clock

Course Outcomes:

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

1. Develop assembly language programs using 8086 microprocessors.
2. Design and interface peripherals with 8086 microprocessors.
3. Understand the basic operation of Peripherals.
4. Develop assembly language programs using 8051 microcontrollers.
5. Design 8051/ARM microcontroller-based systems.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech. II Year II Semester

20CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Pre-requisite Basic knowledge about sciences up to intermediate or equivalent level.

Course Description:
The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:
1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 6 hours
Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

UNIT II ECOSYSTEMS 6 hours
Concept of an ecosystem. Structure – functions – Producers, Consumers and Decomposers – Ecological succession – Food chains, Food webs and Ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystems: Forest, Desert and Lake.

UNIT III BIODIVERSITY AND ITS CONSERVATION 6 hours
Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION 6 hours
Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 6 hours

Urban problems related to Water conservation, rain water harvesting and watershed management; Climate changes: global warming, acid rain, ozone layer depletion, nuclear accidents. Case Studies: Population growth, variation among nations and population explosion.

Course Outcomes:

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

1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by R. J. Ranjith Daniels and Jagdish Krishnaswamy, (Wiley Re- print version 2014).
3. Chemistry for Environmental Engineering/C.N. Sawyer, P.L. McCarty, G.F. Parkin (TataMcGraw Hill, Fifth Edition, 2003).
4. Environmental Chemistry by B.K. Sharma, (Goel Publishing House, 2014).
5. Environmental Studies by Benny Joseph (TataMcGraw Hill, Second Edition, 2009).

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2 Perspectives in Environmental Studies, Second edition, Anubha Koushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.
3 R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

III Year I Semester

B. Tech III Year I Semester

20ECE108 ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

L	T	P	C
2	1	0	3

Pre-requisite **20MAT101, 20PHY102**

Course Description:

The course will provide strong foundation on vector algebra, Vector Calculus, waves in dielectric and conducting media, wave polarization, wave reflection, refraction, transmission lines which will be useful for creating foundation of communication with wave phenomena. The course covers theory and methods to develop expertise in EM field and transmission line approaches associated with it. Student will understand application EM waves and transmission lines.

Course Objectives:

This course enables students to

1. Understand how formulae are related to solve problems and identify the keywords in a given law which is essential for the application of the law and solve many problems.
2. Understand the Static electrostatic field.
3. Understand the Magnetostatic field.
4. Study different EM wave propagation.
5. Understand the Transmission line parameter analysis.

UNIT I ELECTROSTATICS 9 hours

Introduction Coulomb's Law, Electric Fields due to Continuous Charge Distributions, Electric Flux Density, Gauss's Law-Maxwell's Equation, Applications of Gauss's Law, Electric Potential, Relationship between E and V -Maxwell's Equation, Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields, Polarization in Dielectrics, Continuity Equation and Relaxation Time, Boundary conditions at electric interfaces, Method of images and its applications.

UNIT II MAGNETOSTATICS 9 hours

Biot-Savart's Law, Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law, Magnetic Flux Density—Maxwell's Equation, Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields on moving charge and current element, Magnetic Torque and Moment, Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy.

UNIT IV MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVE PROPAGATION 9 hours

Faraday's Law of Induction, Transformer and Motional EMFs, Displacement Current and Displacement Current Density, Maxwell's Equations for Time-Varying field, Maxwell's Equations for Time-Harmonic Fields, EM Waves equation and Solution of EM Wave equation, Wave Propagation in different medium (Lossy Dielectrics, Lossless Dielectrics, Free Space and Good Conductors), Power and Poynting Vector, Reflection of a Plane Wave at Normal Incidence, EM Wave Polarization.

UNIT IV TRANSMISSION LINES 9 hours

Introduction Transmission Line, Distributed Parameters of Transmission Line, Transmission Line Equations and Solution, Physical Interpretation of Voltage and Current Solutions, Primary & Secondary Constants, Lossless and Distortion Less Transmission Line, Loading and Different Methods of Loading, Input Impedance, Reflection Co-Efficient, Voltage Standing Wave Ratio (VSWR),

UNIT V TRANSMISSION ANALYSIS 9 hours

Impedance Matching Techniques, Impedance Matching With Single and Double Stub Impedance Matching. Introduction to Smith Chart , Matching Using Smith Chart.

Introduction to Network Parameters, Z-Parameters, Y-Parameters and S-Parameters

Course Outcomes:

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

1. Understand the fundamentals of vector analysis and vector calculus with introduction to maxwell's relation.
2. Analyze the Electrostatic Field in vacuum or free space.
3. Analyze the static magnetostatic Field.
4. Analyze the EM wave propagation in different media.
5. Analyze the transmission line equation, characteristic quantities, use of smith chart and various application of transmission line.

Text Book(s)

1. N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008.

2. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems –PHI, 2^{nd} Edition, 2000

Reference Books

1. J. D Krauss et.al. "Antennas and Wave Propagation", TMH 4th edition, 2010.

2. David Halliday, Robert Resnick and Kenneth S. Krane Physics, Vol. 2, John Wiley & Sons, Inc., Fifth edition, 2002.

3. Matthew. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics," TMH, 7th ed., 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year I Semester

20ECE109 ANALOG COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE105**

Course Description:

The objectives of this course is to introduce the fundamental principles and mathematical model to analyse and design of analog communication systems. Topics include: signal representation in both time and frequency domain, transmission of signal through LTI System, autocorrelation and power spectral density, time and frequency domain analysis of analog continuous wave modulation and demodulation, frequency division multiplexing, performance analysis continuous wave modulation techniques in additive white Gaussian noise (AWGN) channel, verifications of sampling theorem, analog pulse modulation techniques, concepts of pulse code modulation, information theory, entropy, source coding, discrete memoryless channel and channel coding techniques.

Course Objectives:

This course enables students to

1. Understand the transmission of random signal both in time and frequency domain.
2. Analyse various amplitude modulation and demodulation techniques.
3. Evaluate the performance of angle modulation and demodulation in the presence of noise.
4. Understand sampling theorem and various analog pulse modulation techniques.
5. Understand the concepts of information theory, source coding and channel coding techniques.

UNIT I RANDOM PROCESS FOR COMMUNICATION 9 hours

Elements of an electrical communication system, Characteristics of communication channel and their mathematical modeling, Signal models: deterministic and random, Random variable, Random Process, Mean and Variance of random process, Stationary Processes, Ergodic Processes, Transmission through LTI, Principles and properties of Autocorrelation and cross correlation, Power spectral density. Gaussian process, White process, Central Limit Theorem.

UNIT II AMPLITUDE MODULATION SYSTEMS 9 hours

Amplitude modulation: Concepts of Modulation, Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB); double sideband suppressed carrier (DSBSC); single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation and demodulation.
Noise: External and internal sources of noise, Thermal noise, Representation of narrowband noise; receiver model- Tuned radio frequency receiver, Superheterodyne receiver, signal to noise ratio (SNR), noise figure, Noise temperature, Equivalent noise bandwidth, Noise in Amplitude Modulation: DSB-SC, SSB-SC and AM system,

UNIT III ANGLE MODULATION SYSTEMS 9 hours

Angle modulation: Concepts of Instantaneous frequency and phase, phase modulation (PM) & frequency modulation (FM) and demodulation; Bandwidth of FM, Wideband and Narrowband FM, Concept of Frequency division multiplexing.
Noise in angle modulation systems: Noise in FM and PM, Pre-emphasis and De-emphasis in FM, **Threshold effect in angle modulation.**

UNIT IV ANALOG PULSE MODULATION SCHEMES 9 hours

Sampling process, sampling theorem, signal reconstruction, flat-top sampling of band pass signals, Analog Pulse Modulation, Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Spectra of pulse modulation, concepts of pulse code modulation.

UNIT V INFORMATION THEORY & CHANNEL CAPACITY 9 hours

Measure of information, Entropy, Source Coding Theorem, Hamming weight and distance, Syndrome Coding, Shannon Fano and Huffman Coding, Discrete memory less channels, Channel Coding, Error Control Codes, Linear block code and convolutional codes, Nyquist bandwidth, Shannon-Hartley capacity theorem.

Course Outcomes:

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

1. Analyze the transmission of random signal both in time and frequency domain.
2. Analyze the amplitude modulation and demodulation techniques in communication systems
3. Analyze the angle modulation and demodulation techniques in communication systems
4. Understand the concepts of anlog pulse modulation.
5. Use source and channel coding technique to improve system performance.

Text Book(s)

1. Simon Haykin & Michael Moher, Communication Systems, John Wiley & Sons, 5th Edition, 2010.

2. B. P. Lathi and Z. Ding, *Modern Digital and Analog Communication Systems*, 4th edition, Oxford , 2011

Reference Books

1. H Taub & D. Schilling, Gautam Sahe, Principles of Communication Systems, 3rd Edition, Tata McGraw Hill, 2007

2. H.P. Hsu, Analog and Digital Communication, 3rd edition, McGraw Hill Education, 2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year I Semester

20ECE110 DIGITAL SIGNAL PROCESSING

L	T	P	C
2	1	0	3

Pre-requisite 20ECE105

Course Description:

This course gives **b**ackground and fundamental material for the analysis and processing of digital signals. Various mathematical tools such DFT and FFT are explained followed by its application in transform domain analysis of LTI system. Furthermore, the detailed design and structures of FIR and IIR systems are discussed for low-pass, high-pass, band-pass and band stop filtering application. Subsequently, discussed about architectures and programmability of digital signal processor. Finally, concepts of multirate are discussed for audio and speech applications of DSP in real time.

Course Objectives:

This course enables students to

1. Develop knowledge in efficient transforms in the frequency domain and analyze their properties
2. Study the designs and structures of digital (IIR) filter from analysis to synthesis for a given specifications.
3. Study the designs and structures of digital (FIR) filter from analysis to synthesis for a given specifications.
4. Acquire knowledge about real time implementation of various digital signal processing algorithms in DSP hardware.
5. Discuss application areas with particular stress on audio and speech data.

UNIT I FREQUENCY DOMAIN TOOLS FOR SIGNAL PROCESSING IN DIGITAL DOMAIN 9 hours

Discrete Fourier Transform (DFT): Concept of Frequency domain sampling and reconstruction of discrete time Signals, Discrete Fourier Transform, DFT as a Linear Transformation, and Relationship of DFT to other transforms, Properties of DFT, Use of DFT in linear filtering, filtering long data sequences: overlap-save, overlap-add method.

Fast Fourier Transform (FFT) algorithms: Direct computation of DFT, Radix-2 FFT algorithm: Decimation-in-time algorithm, Decimation-in-frequency algorithm.

UNIT II INFINITE IMPULSE RESPONSE (IIR) FILTER DESIGN 9 hours

Analog Filters: Concept of Filtering, Analog filter specifications, Classification of Analog filters: Butterworth and Chebyshev Approximations, Design of Analog Filters (Low pass, High pass, Band pass, Band stop Filters) using Frequency transformations.

Simple Digital Filters: Concept of Digital Domain Filtering, 1^{st} order FIR Lowpass, High pass Filters, 2^{nd} order FIR Bandpass, Band stop Filters, 1^{st} order IIR Lowpass, High pass Filters, 2^{nd} order IIR Bandpass, Band stop Filters, FIR All Pass Filters, IIR All Pass Filters, Digital Filter Specification

Digital IIR Filters Design: Design of Digital IIR Filter (Low pass, High pass, Band pass, Band stop Filters) using Impulse Invariant, Bilinear Transformation Techniques.

Realization of IIR filters: Direct form (I and II), Cascade, Parallel (I and II), and Transposed structures for realizing IIR Filters

UNIT III FINITE IMPULSE RESPONSE (FIR) FILTER DESIGN 9 hours

Digital FIR Filters: Concept of FIR Filtering, Linear Phase Transfer Functions – Type I, Type II Type III and Type IV Transfer Functions, Design of Linear Phase FIR Filters using Frequency Sampling, Windowing Methods.

Finite word length effects: Quantization of input signal, filter coefficient, Round-off effect in digital filters.

Realization of FIR Filters: Direct form structures, cascade form structures and lattice structures for realizing FIR filters

UNIT IV DIGITAL SIGNAL PROCESSOR 9 hours

Introduction to DSP Processor: Basics of Programmable DSP Architecture – Von-Neumann, Harvard, Super Harvard, VLIW Architecture, and Numeric Representation in DSP Processor – Fixed Point and Floating-Point Representation.

TMS320C6713 Processor: Architecture, Pipelining, Linear and Circular Addressing Modes, Instruction sets, Assembler Directives, Interrupts, Memory Considerations, Implementation of FIR and IIR filters.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9 hours

Sampling Rate Conversion: Basic Sampling Rate Conversion Tools – Up-Sampler, Down-Sampler, Time Domain and Frequency Domain Characterization of Up-Sampler and Down-Sampler, Multirate Structure for Sampling Rate Conversion - Decimator, Interpolator, Cascade Equivalences, Fractional Sampling Rate Conversion, Concept of Multistage Sampling Rate Conversion, Polyphase Decomposition for Efficient Realization of Interpolator and Decimator Structure.

Application of Multirate DSP: Design of Phase Shifters, Sub-band Coding of Speech Signals using Quadrature Mirror Filters

Course Outcomes:

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

1. Understand different types of mathematical tools such as DFT, FFT and use them in analyzing discrete time signals in transform domain.
2. Design Digital IIR filters to meet desired frequency response specification for low-pass, high-pass, band-pass and band-stop filtering application and Realize the designed filters using Direct, Cascade, Parallel and Transpose Structures.
3. Design Digital FIR filters to meet desired frequency response specification for low-pass, high-pass, band-pass and band-stop filtering application and Realize the designed filters using Direct, Cascade, and Lattice Structures.
4. Acquire basic knowledge on DSP processors architecture and programmability of TMS320C6713 Digital Signal Processor.
5. Understand basic concepts on Multirate Structures for Sampling Rate Conversion and Apply them in Phase Shifter Design and Subband-Coding of Speech Signal

Text Book(s)

1. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education Asia/Prentice Hall of India, 2014.
2. Rulph Chassaing, Donald Reay, "Digital Signal Processing and Applications with TMS320C6713 and TMS320C6416 DSK", 2 nd Edition, Wiley India, 2014.

Reference Books

1. S. K. Mitra, "Digital Signal Processing: A Computer based Approach", 4th Edition, McGraw Hill, 2013.
2. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors – Architectures, Implementations and Applications", Pearson/Prentice Hall, 2005.
3. Emmanuel Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Pearson Education, 2002.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year I Semester

20ECE207 ANALOG COMMUNICATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

This laboratory course is designed to help the students to analyse various analog modulation and demodulation techniques and frequency division multiplexing. Students also analyse sampling theorem, various pulse modulation and demodulation techniques, frequency synthesizer and mixer used in analog communication systems.

Course Objectives:

This course enables students to

1. Understand how signals are amplitude modulated and demodulated in the transmitter and receiver, respectively, in analog communication.
2. Understand how signals are frequency modulated and demodulated in the transmitter and receiver, respectively, in analog communication
3. Understand how more than one signals are Frequency-Division multiplexed in the transmitter and how it is demultiplexed in the receiver so that the signal reaches to the intended user at the destination.
4. Understand how analog signals are converted into pulses of varying characteristics in communication
5. Understand the effect of noise communication in analog communication.

LIST OF EXPERIMENTS:

1. Amplitude Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. SSB-SC Modulation and Demodulation
4. Frequency Modulation and Demodulation
5. Study of spectrum analyzer and analysis of AM and FM Signals
6. Pre-emphasis and De-emphasis Filter
7. Frequency Division Multiplexing & De multiplexing
8. Sampling and Reconstruction
9. Pulse Amplitude Modulation & Demodulation
10. Pulse Width Modulation & Demodulation
11. Pulse Position Modulation & Demodulation
12. Design and analysis of analog RC filter using MATLAB
13. Study and simulation of signals in the presence of noise using MATLAB
14. Analysis of Linear Block Codes using MATLAB

Course Outcomes:

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

1. Analyse various amplitude modulation and demodulation techniques
2. Analyse frequency modulation and demodulation
3. Apply Frequency Division Multiplexing and Demultiplexing for communication
4. Analyse pulse modulation techniques, such as PAM, PWM, PPM
5. Analyse analog communication system in the presence of noise.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

20ECE208 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

This course is designed to help the students in implementing basic DSP algorithms in MATLAB and then using DSP processor. This laboratory starts with the simulation of Magnitude and Phase Spectrum analysis using DFT is demonstrated. Subsequently, design of IIR and FIR filters is illustrated for low-pass and high-pass filtering, which is followed by demonstration of Interpolator and Decimator implementation for Multirate DSP system analysis. Finally, as an application of DSP, design of digital filter for noise suppression is illustrated.

Course Objectives:

This course enables students to

1. Ability to apply knowledge of mathematics, science and engineering: Construction of tools for visualizing the basic concepts of discrete signal representation such as Fourier transforms, discrete time representations.
2. Design and implementations of IIR and FIR filtering algorithms and structures.
3. Understand the concept of Multi-rate signal processing and sample rate conversion
4. Understand the basics of using DSP chips to perform real-time digital signal processing.
5. Develop and Implement DSP algorithms in software using CCS with DSP floating point Processor.

LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Spectrum Analysis using Discrete Fourier Transform (DFT)
2. Implementation of DIT-FFT and DIF-FFT algorithm to compute DFT coefficients of DT signals
3. Design of Analog (Butterworth and Chebyshev) Filters for Lowpass and Highpass Filtering Application
4. Design of Digital IIR Filters using Impulse Invariant and Bilinear Transformation Techniques for Lowpass and Highpass Filtering Application
5. Realize Digital IIR Filter Transfer Function using Direct, Cascade, Parallel Structures
6. Design of Digital FIR Filters using Frequency Sampling and Windowing Techniques for Lowpass and Highpass Filtering Application
7. Realize Digital FIR Filter Transfer Function using Direct, Cascade, Lattice Structures
8. Implement Multirate Structures for Sampling Rate Conversion (Interpolation, Decimation, Fractional Sampling Rate Conversion)

DSP PROCESSOR BASED IMPLEMENTATION

1. Real Time Signal Generation using TMS320c6713 Processor
2. Implementation of Discrete Time Convolution using TMS320c6713 Processor
3. Implementation of DFT and FFT using TMS320c6713 Processor
4. Design of IIR Filter for Low pass, High pass, Band pass and Band Stop Filtering using TMS320c6713 Processor.
5. Design of FIR Filter for Low pass, High pass, Band pass and Band Stop Filtering using TMS320c6713 Processor.
6. Implementation of Interpolator and Decimator for Sampling Rate Conversion using TMS320c6713 Processor

Course Outcomes:

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

1. Analyze spectrum of DT signals using transform domain mathematical tools such as DFT, FFT
2. Design and Realize IIR filters for Low pass and High pass Filtering Application
3. Design and Realize FIR filters for Low pass and High pass Filtering Application
4. Analyze Multirate Structures for Sampling Rate Conversion (Interpolation, Decimation, Fractional Rate Conversion)
5. Implement FIR and IIR Filters in DSP Processor and Apply the same for filtering of Signals in Real Time

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech III Year I Semester

20HUM902 / 20HUM102# UNIVERSAL HUMAN VALUES**

L	T	P	C
2**/3#	0	0	0**/3#

Pre-requisite None.

Course Description:
This course discusses students' role in their family and briefly touches issues related to their role in the society and the nature.

Course Objectives:
This course enables students to

1. Understand Happiness and Prosperity correctly and basic Human Aspirations
2. Able to self-verify the Harmony in the Human Being
3. Visualize a universal harmonious order in society which leads to Undivided Society at Universal Order- from family to world family.
4. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
5. Implicate the UHV in professional ethics.

UNIT I The Process for Value Education - Basic Human Aspirations 8 hours

L1: Purpose and motivation for the course, recapitulation from Universal Human Values-I
L2: Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
L3: Continuous Happiness and Prosperity- A look at basic Human Aspirations
L4: Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
L5: Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
L6: Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
T1 & T2: Discussion on natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II Understanding Harmony in the Human Being - Harmony in Myself! 8 hours

L7: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
L8: Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
L9: Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
L10: Understanding the characteristics and activities of 'I' and harmony in 'I'
L11: Understanding the harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
L12: Programs to ensure Self-regulation and Health.
T3 & T4: Discussion on the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT III Understanding Harmony in the Family and Society 7 hours

L13: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

L14: Understanding the meaning of Trust; Difference between intention and competence

L15: Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
L16: Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
L17: Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
T5 & T6: Reflection on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT IV Understanding Harmony in the Nature and Existence 6 hours

L18: Understanding the harmony in the Nature

L19: Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature

L20: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

L21: Holistic perception of harmony at all levels of existence.

T7 & T8: Discussion on human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V Implications of Holistic Understanding of Harmony on Professional Ethics 11 hours

L22: Natural acceptance of human values
L23: Definitiveness of Ethical Human Conduct
L24: Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
L25; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
L26: Case studies of typical holistic technologies, management models and production systems
L27: Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
L28: Sum up.
T9-T14: Exercises and Case Studies For e.g. Individual discussion on the conduct as an engineer or scientist etc.

Course Outcomes:

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

1. Understood the natural acceptance in human being as the innate acceptance,
2. More aware of themselves,
3. Maintain harmony with family and society by recognizing Harmony in Human-Human Relationship,
4. Try to get Harmony in the Nature and Existence by realizing existence as Coexistence
5. More responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind with better critical ability.

Text Book(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

Mode of Evaluation: Assignment / Quiz, Classroom participation, Mini project / Report, Internal Mid Examination and external semester end examination.

III Year II Semester

B. Tech III Year II Semester

20ECE111 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102**

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to
1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours
Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours
Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours
FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

Course Outcomes:

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

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

Text Book(s)

1. Neil H.E. Weste, David Money Harris “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, ”Digital Integrated Circuits:A Design perspective”, Second Edition , Pearson , 2016.

Reference Books

1. M.J. Smith, “Application Specific Integrated Circuits”, Addisson Wesley, 1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim “CMOS Digital Integrated Circuits:Analysis & Design”,4th edition McGraw Hill Education,2013
3. Wayne Wolf, “Modern VLSI Design: System On Chip”, Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year II Semester

20ECE112 ANTENNA AND MICROWAVE ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite 20ECE108

Course Description:

The course will introduce the students about the antenna radiation mechanism along with the different important parameters of the antenna. The course will give an overview of different types of antennas and there working principle. Further, in this course different RF and Microwave spectrums will be discussed along with its applications. Students will learn about microwave networks, power dividers, couplers, etc. and microwave measurement with test bench.

Course Objectives:

This course enables students to

1. Study about brief history of antenna and different types of antenna
2. Know the fundamental parameters of antenna design
3. Analysis of different types of antennas
4. Study about different Microwave Spectrum and application of microwave signals
5. Design and analysis of microwave networks and know the various measurement of microwave

UNIT I INTRODUCTION TO ANTENNA THEORY 9 hours

Introduction to Antenna- Introduction, Historical Advancement, Types of Antennas, Radiation Mechanism- Radiation pattern, Radiation pattern Lobes, Isotropic, Directional, and Omnidirectional Patterns, Radiation Power Density, Radiation Intensity, Beam-width, Directivity, Gain of Antenna, Beam Efficiency, Bandwidth, Polarization, Input impedance, Antenna Radiation Efficiency, Friis transmission equation, radar range equation

UNIT II ANTENNA ARRAYS 9 hours

Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

UNIT III INTRODUCTION TO MICROWAVE ENGINEERING 9 hours

Introduction to RF& Microwave Spectrum, History of Microwaves, Applications of Microwaves: Civil and Military, Medical, Safety considerations, Modern Trends in Microwaves Engineering, Radio Aids to Navigation, RFID, GPS, Effect of Microwave on human Body.

UNIT IV MICROWAVE DEVICE DESIGN 9 hours

Three port and Four Port networks, T junction and resistive power divider, Wilkinson power divider, Rat race Coupler (180_o hybrid coupler) Microwave Filters: Filter design by insertion loss method, Low pass filter implementation (Butterworth and Chebyshev)-Richards transformation, Kuroda's identity - Stepped impedance.

UNIT V MICROWAVE NETWORK ANALYSIS AND MICROWAVE MEASUREMENTS 9 hours

Microwave network Analysis - Scattering matrix - reciprocal networks and lossless networks, generalized S-parameters, signal flow graph–decomposition of signal flow graphs. Wilkinson power Divider

Microwave Tubes: TWT, Klystron amplifier, Reflex Klystron, Magnetron.
Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT PIN Diode.

Course Outcomes:

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

1. Distinguish different types of antennas used in real world
2. Understand the concepts of antenna parameters and apply them for antenna analysis
3. Design and analysis of different types of antennas
4. Understand RF spectrum, its application and history of microwaves.
5. Design and analysis of Microwave devices along with Understand the methods used to measure different parameters of Microwave Engineering

Text Book(s)

1. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley,4th edition, February 2016

2. Microwave Engineering, M. Pozar, Willey & Sons Inc. 4th Edition, 2011

Reference Books

1. Microwave Devices and Circuits, Samuel Y. Lio , Pearson, 3rd edition, 2003

2. J.D. Kraus, Antennas, McGraw Hill,3rd edition 2001.

3. Microwave Engineering, A Das & S Das. Mc Graw Hill, 3rd Edition, 2017

4. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005.

5. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year II Semester

20ECE113 DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE109**

Course Description:

Digital communication is a fundamental course in the electronics and communication stream. The objectives of this course is to introduce the fundamental principles and mathematical model to analyse and successful design of a digital communication system. Topics include conversion of analog waveforms into coded pulses, baseband modulation and optimal detections, design of digital bandpass modulation techniques such as Binary Phase Shift Keying (BPSK), Frequency Shift Keying (FSK), Quadrature Amplitude Modulation (QAM), M-ary Phase Shift Keying (M-PSK) etc. The course also includes performance evaluation of various digital bandpass modulation techniques in terms of bit-error-rate and capacity. Other fundamental concepts such as the effects of inter-symbol-interference (ISI), equalization technique and carrier recovery are studied.

Course Objectives:

This course enables students to

1. Gain the knowledge of fundamental operations e.g. sampling, quantization, and coding to convert analog waveforms into coded pulses.
2. Characterize the baseband signal modulation in time and frequency domains and to design the optimum receiver for it.
3. Develop understanding of digital passband transmission techniques (i.e., BPSK, BASK, BFSK, QAM, QPSK) and their transmission and reception.
4. Determine the performance of various digital bandpass modulation techniques in terms of bit-error-rate and capacity.
5. Analyze the effects of inter-symbol-interference of digital modulation techniques in band limited channel and design the equalizer to mitigates the effects of ISI.

UNIT I CONVERSION OF ANALOG WAVEFORMS INTO CODED PULSES 9 hours

Review of Sampling theory, Nyquist criterion, Aliasing effect, Quantization: Uniform and non-uniform quantization, Pulse code modulation (PCM), Quantization noise and signal to quantization noise ratio, Differential PCM (DPCM), Delta modulation, Adaptive delta modulation, Noise in delta modulation: Granular and slope overload distortions. Time division multiplexing (TDM), Digital telephony: T1 carrier system.

UNIT II DIGITAL BASEBAND TRANSMISSION AND RECEPTIONS 9 hours

Concepts of line coding & its properties. NRZ & RZ types, signalling format for unipolar, polar, bipolar (AMI) & Manchester coding and their power spectra. Optimum receiver for baseband in additive white Gaussian noise (AWGN): Matched filter, derivation of its impulse response and peak signal to noise ratio, matched filter as correlator receiver.

UNIT III DIGITAL BANDPASS TRANSMISSION AND RECEPTION 9 hours

Types of digital modulation, waveforms and mathematical expressions for amplitude, frequency and phase shift keying, Concepts of constellation diagram, method of generation and detection of binary ASK, FSK & PSK, differential phase shift keying, M-ary PSK (M-PSK), M-ary quadrature amplitude modulation (M-QAM).

UNIT IV PERFORMANCE ANALYSIS OF DIGITAL BANDPASS SYSTEMS 9 hours

Probability of error for BPSK, BASK and BFSK. Performance comparison of various digital modulation techniques. Shannon- Hartley capacity theorem, BW efficiency of different modulation schemes, Modulation & coding trade-offs, bandwidth- SNR trade-off.

UNIT V EQUALIZATION AND CARRIER RECOVERY TECHNIQUES 9 hours

Inter Symbol Interference (ISI) – Nyquist criterion for distortion less transmission – Raised cosine spectrum – Correlative coding – Eye pattern, Equalization- zero forcing and basics of adaptive linear equalizers, **Synchronization and Carrier Recovery for Digital modulation.**

Course Outcomes:

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

1. Acquire the knowledge of fundamental operations sampling, quantization, and encoding for conversion of analog waveforms into coded pulses.
2. Design of optimal receiver filter for digital baseband modulation.
3. Analyse the time and frequency domain representations of digital bandpass modulation
4. Determine the bit error rate performance of various digital bandpass modulations.
5. Understand the effects of inter-symbol interference due to bandlimited channel and mitigates the effects by equalization techniques to improve the performance.

Text Book(s)

1. S. Haykin, *Digital Communication Systems*, 1st edition, Wiley , 2013

2. B. P. Lathi and Z. Ding, *Modern Digital and Analog Communication Systems*, 4th edition, Oxford , 2011

Reference Books

1. B. Sklar and P. K. Ray, *Digital Communications: Fundamentals and Applications*, 2nd edition, Pearson , 2009.
2. J. G. Proakis and M. Salehi, *Digital Communications*, 5th edition, McGraw Hill , 2014

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year II Semester

20ECE209 VLSI DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE102**

Course Description:

This course provides hands on experience to students on design and implementation various digital circuits using hardware design language Verilog HDL.

Course Objectives:

This course enables students to

1. Learn Hardware Descriptive Language (Verilog/VHDL)
2. Learn the fundamental principles of VLSI circuit design in digital domain.
3. Learn the fundamental principles of VLSI circuit design in analog domain.
4. Familiarize fusing of logical modules on FPGAs.
5. Provide hands on design experience with professional design (EDA) platforms

LIST OF EXPERIMENTS

Part I: Digital System Design using HDL & FPGA

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6

Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards

Part-II: Digital Circuit Design

7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops

Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9

Analyze the power, area and timing for experiments 7 to 9 by performing Pre-Layout and Post Layout Simulations.

Part-III Analog Circuit Design

10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers. Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.
12. Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.

Requirements: Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

Course Outcomes:

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

1. Write HDL code for basic as well as advanced digital integrated circuit.
2. Import the logic modules into FPGA Boards.
3. Synthesize Place and Route the digital IPs.
4. Design, Simulate and Extract the layouts of Digital IC Blocks using EDA tools
5. Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

20ECE210 MICROWAVE ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE108, 20ECE112**

Course Description:

This laboratory course is designed to provide basic understanding on measurements techniques used at microwave frequencies. The knowledge obtained from this course is useful to have firsthand knowledge and hands on experience in standing wave phenomenon on transmission lines.Course covers: Reflex Klystron Characteristics, Gunn Diode Characteristics, Attenuation measurement, Directional Coupler Characteristics, VSWR Measurement, Impedance Measurement, waveguide parameters measurement, measurement of scattering parameters of Directional Coupler, and Magic Tee

Course Objectives:

This course enables students to

1. This course designed to understand frequency spectrum of RF wave design two cavity klystron with output power and efficiency calculation.
2. To Measure attenuation VSWR impedance waveguide parameters of microwaves devices
3. To develop the knowledge on transmission lines for microwaves, resonators and wave guide components and applications.
4. To analyze the SWR measurement.
5. To explain the ideas about measurement of reflex klystron and Gunn diode characteristics.

LIST OF EXPERIMENTS

Hardware Experiments

1. Characteristics of Klystron tube and to determine its electronic tuning range.
2. Gunn Diode characteristics
   2.1 Output power and frequency as a function of voltage.
   2.2 Square wave modulation through diode
3. Attenuation Measurement.
4. Directional Coupler Characteristics
5. Waveguide parameters measurement.
6. VSWR Measurement.
7. Impedance Measurement
8. Scattering parameters Magic Tee

Simulation Experiments

9. Dipole Antenna Design and Simulation using CEM-ONE
10. Yagi-Uda Antenna simulation using CEM-ONE
11. Magic Tee Simulation using CEM-ONE
12. Antenna Design and Analysis using MALAB

Course Outcomes:

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

1. Analyze the microwave bench working.
2. Analyze the SWR measurement technique.
3. Analyze the measurement of reflex klystron and Gunn diode characteristics.
4. Understand well about measurement of scattering parameters.
5. Learn to use simulation software’s.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

20ECE211 DIGITAL COMMUNICATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

This laboratory course is designed to help the students to analyse various digital modulation and demodulation techniques and Time Division Multiplexing. Students also analyse PCM, delta modulation, companding and various channel encoding and decoding used in digital communication systems.

Course Objectives:

This course enables students to

1. Understand how the analog signals are converted into binary data using pulse code modulation and delta modulation
2. Understand how Time Division Multiplexing and Demultiplexing is used in communication to send signals from many users on a single channel/medium and distributed to the intended user at the destination
3. Understand how the binary data is modulated in the transmitter and demodulated in the receiver using different modulation and demodulation techniques
4. Understand how A-Law & μ-Law are applied for companding signals in PCM
5. Understand the need for channel coding and how the data is encoded in the transmitter and decoded in the receiver.

LIST OF EXPERIMENTS:

1. Pulse Code Modulation and Demodulation
2. Differential Pulse Code Modulation and Demodulation
3. Delta Modulation and Demodulation
4. Time Division Multiplexing & De multiplexing
5. ASK, FSK, PSK Modulation and Demodulation
6. Differential PSK (DPSK) Modulation and Demodulation
7. Quadrature PSK (QPSK) Modulation and Demodulation
8 Quadrature Amplitude Modulation (QAM) and Demodulation
9. Digital Companding (A-Law & μ-Law)
10. Linear Block Code- Encoder and Decoder
11. Convolutional Code- Encoder and Decoder
12. Performance comparison of Line Coding techniques using MATLAB
13. BER Performance analysis of digital modulation schemes using MATLAB

Course Outcomes:

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

1. Analyse pulse code modulation and delta modulation used in communication
2. Apply Time Division Multiplexing and Demultiplexing for signals in communication
3. Analyse various pass band modulation and demodulation techniques
4. Apply A-Law & μ-Law companding of signals
5. Understand various channel decoding and encoding for communication
6.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech III Year II Semester

20CE901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Pre-requisite **None**

Course Description:

The goal of this course is to expose the under graduate students regarding different types of disasters and preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical and emerging hazards and risks that may cause property, loss of lives, and livestock's. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

This course enables students to

1. Make aware the students about disasters and their impact on living beings
2. Ensure the students for the understanding on vulnerability, disasters, disaster prevention and risk reduction.
3. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes available in the country for the disaster risk mitigation.
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION 6 hours

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

UNIT II TYPES OF DISASTERS 6 hours

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS 6 hours

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES 6 hours

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 6 hours

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

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

1. Understanding on the nature of disasters
2. Application of Disaster Concepts to Management
3. Analyzing Relationship between Development and Disasters.
4. Ability to understand Categories of Disasters.
5. Realization of the responsibilities to society

Text Book(s)

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/%20(National%20Disaster%20management%20in%20India,%20Ministry%20of%20Home%20Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments and Mid Term Tests

Open Elective - II

Open Elective - II

20MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT107, 20MAT110

Course Description:
This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis. The students use MATLAB as the computer language to obtain solutions to a few assigned problems.

Course Objectives:
1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours
Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial - Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.
Exercises of Bisection method and Newton's method through MATLAB

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS 9 hours
Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms- Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.Exercises of Gaussian Elimination and Gauss-Seidel method through MATLAB

UNIT III INTERPOLATION & NUMERICAL CALCULUS 9 hours
Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature - Exercises of Divided differences and Simpson's rule through MATLAB

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours
Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.
Exercises of Runge-Kutta method and Shooting method through MATLAB.

UNIT V NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Finite difference methods for one-dimensional Wave and Heat equations; Laplace and Poisson equations (five-point formula) - Exercises of Finite difference method (forward, central and backward differentiation) and Crank-Nicolson method through MATLAB

Course Outcomes:

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

1. Solve the system of algebraic and transcendental equations.
2. Apply the numerical techniques to find the solution to system of equations.
3. Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.
4. Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Compute the solutions for engineering problems represented by partial differential equations.

Text Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - II

20MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT106, 20MAT104, 20MAT108, 20MAT109, 20MAT110.

Course Description:

Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:

1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to solve dynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV DYNAMIC PROGRAMMING 9 hours

Introduction, developing optimal decision policy, Dynamic Programming Problem (DPP) under certainty, DPP approach for solving LPP.

UNIT V PROJECT MANAGEMENT AND QUEUING MODELS 9 hours

Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to queuing system, single server queuing models (M/M/1) :(∞/FCFS), (M/M/1): (N/FCFS).

Course Outcomes:

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

1. Understood the importance of unconstrained and constrained optimization to solve engineering problems.
2. Get an idea about the linear programming techniques.
3. Solve transportation and assignment problems in engineering situations.
4. Apply the Bellman principle of optimality to solve dynamic programming problem.
5. Analyze the problems of network analysis for project management and Queuing systems engineering & industry.

Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2ndedition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - II

20PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

Course Objectives:
Students will
1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field
4. Provide students with a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

UNIT I INTRODUCTION 9 hours
Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigenvalues and Eigenvectors.

UNIT II ABERRATIONS AND OPTICAL INSTRUMENTS 9 hours
Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

UNIT III WAVE OPTICS & INTERFERENCE 9 hours
Huygens's principle, Superposition of waves, Fourier transforms, representation of slits and apertures, Two beam interference by Division of wave front. Applications of Interference, Nonlinear interaction of light with matter (self-study).

UNIT IV DIFFRACTION & POLARISATION 9 hours
Fraunhoffer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

UNIT V FIBER OPTICS 9 hours
Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communications, sensors and medicine.

Course Outcomes:
At the end of the course, students will be able to:
1. Recollect the fundamental characteristics of light and their mathematical principles.
2. Learn the principles of superposition, Interference and Diffraction
3. Understand nonlinear optics and photonics phenomena.
4. Be exposed to the application of optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

Text Books:

1. Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

Reference Books

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).
2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:
Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:
1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours
Energy levels & Radiative properties of Atoms and molecules; Atomic lasers: He-Ne laser, Argon Ion laser; Molecular Lasers: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours
Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)
Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

UNIT IV PULSED OPERATION OF LASERS 9 hours
Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.
Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours
Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.
2. Estimate stability requirements in producing laser light by different types of sources
3. Differentiate or list the various types of lasers and their means of excitation.
4. Assess (Identify) which laser would best meet the need for a particular industrial or research task.
5. Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text Books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - II

20CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

It deals with basic principles of petroleum engineering and the processes involved in petroleum industry.

Course Objectives:

Students will

1. To understand the basic concepts of crude oil, distillation process, internals, petroleum products and their properties, Instruments used for fuel testing.
2. To understand the type of chemicals and their application in petroleum industry.
3. To introduce the basic principles of hydroprocessing and fluid catalytic cracking and familiarize the processes involved there.
4. To familiarize the basic concepts of catalysis, bioprocesses in the refinery.
5. Health, environment, process safety and management in petroleum companies.

UNIT I BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING 9 hours

Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant. Density, viscosity, pour point, flashpoint, octane number, cetane number, Fire point, Chromatography, Ductility, Water content, Sulphur analysis, MCRT, SARA, HFRR, calorofic value etc.

UNIT II CHEMICALS AND THEIR IMPORTANCE IN PETROLEUM INDUSTRY 9 hours

Types of products in the refinery and their structural properties, Netralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity improvers, drag reducing agents, antioxidants, Lubricity improvers, Antifoam additives, Oil spill absorbers, Dispersants and their applications, Types of Catalysts used in the refinery, Chemicals for ETP plant.

UNIT III ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY 9 hours

Objectives, Hydrocracking Reactions, Hydrocracking feedstocks, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design concepts, New Designs for Fluidized-Bed Catalytic Cracking Units

UNIT IV ROLE OF CATALYSTS, BIOPROCESSES IN PETROLEUM INDUSTRY 9 hours

Types of catalyst and their importance, Design of catalyst, selection of catalyst, Catalytic processes. Introduction to biotechnology, oil recovery from reservoirs, refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, propanol.

UNIT V HEALTH, ENVIRONMENT, PROCESS SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY 9 hours

Safety policy, Personal protective equipment, Different type of extinguishers, Types of gloves and their application, Hydrants and their role, Safety indicators, Safety contact, Environmental pollution, precaution and first aid, precautions safety, Occupational safety and management, different elements and their role.

Course Outcomes:

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

1. Be able to understand the overview of petroleum industry
2. Be able to understand the concepts of crude oil, types of crude oils, properties of fuels such as octane number, cetane number, viscosity, density etc. Instruments.
3. Be familiarized with importance and their use of chemicals involved in the petroleum industry.
4. Be familiarized with the processes involved in hydroprocessing and fluid catalytic cracking.
5. Be familiarized the types of catalysts and bioprocesses in the petroleum industry.
6. Understanding the PPE, different types of extinguishers, First aid, process safety and management in the petroleum industry.

Text Books:

1. Mohamed A. Fahim, Taher A. Al-Sahhaf, Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009
2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, CHIZINE PUBN, 2017
3. S. P. Srivastava Jenő Hancsók, *Fuels and fuel additives*, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
4. Robert O. Anderson, *Fundamentals of the Petroleum Industry*–University of Oklahoma Pres, 1987.
5. James G.Speight, *Handbook of Petroleum Product Analysis*, John Wiley & Sons, Inc, 2015
6. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company)

Reference Books

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013
2. Petroleum Engineering Handbook (Vol. 1 through VIII). Editor in Chief: Larry W. Lake, Society of Petroleum Engineers.
3. Srinivasan Chandrasekaran. Health, safety and Environmental Management for offshore and Petroleum Engineers, John Wiley and Sons, U.K., ISBN: 978-11-192-2184-5, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies. This course covers feedstocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts and solvents and green processes for Nanoscience.

Course Objectives:
Students will
1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience.

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours
Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours
Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours
Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours
Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and

Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Course Outcomes:

Upon completion of this course the students should:

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco-friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nanoscience.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.

2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geo-synthetics; improvement of expansive soils.

Course Objectives:
Students will

1. To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.
2. To bring out concepts of reinforced earth.
3. Applications of geotextiles in various civil engineering projects.

UNIT I DEWATERING & GROUTINHG 9 hours

Introduction- Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique.
Methods of de-watering- sumps and interceptor ditches- wells- drains- Electro- osmosis. Objectives of grouting- grouts and their properties-grouting methods.

UNIT II DENSIFICATION 9 hours

In - situ densification methods in cohesionless Soils: - Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth. In - situ densification methods in cohesive soils: - preloading or dewatering, Vertical drains - Sand Drains- Sand wick geo-drains
- Stone and lime columns - thermal methods.

UNIT III STABILIZATION 9 hours

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride- sodium silicate and gypsum.

UNIT IV REINFORCED EARTH & GEOSYNTHETICS 9 hours

Principles - Components of reinforced earth - factors governing design of reinforced earth walls design principles of reinforced earth walls. Geotextiles- Types, Functions and applications - geo- grids and geo-membranes - functions and applications.

UNIT V EXPANSIVE SOILS 9 hours

Problems of expansive soils - tests for identification - methods of determination of swell pressure. Improvement of expansive soils - Foundation techniques in expansive soils - under reamedpiles.

Course Outcomes:
After successful completion of the course, student will be able to

1. Evaluate basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
2. Implement different techniques of soil densification.
3. Choose the best method for stabilizing the soil for a given soil condition.
4. Choose-the best geosynthetic materials in different engineering applications.
5. Assessing various types of foundation techniques and methods to control swelling of soil

Text Books:

1. Dr. Purushotham Raj, P., Ground Improvement Techniques, Laxmi Publications, New Delhi.

2. Dr. Sivakumar Babu, GL, An Introduction to Soil Reinforcement & Geosynthetics, Universities Press

Reference Books

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill International Edition, 1990.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

The course will focus on Basic concept of Environmental Impact Assessment (EIA), EIA Methodologies, Impact of Developmental Activities and Land use in soil, water, and vegetation, Environmental Audit, Post Audit activities, The Environmental pollution Acts.

Course Objectives:

Students will

1. To impart knowledge on Environmental management and Environmental Impact Assessment.
2. To give the student the brief knowledge about various legislations and audit protocols.
3. To give student knowledge about the framing of environmental audit through case studies.

UNIT I CONCEPTS AND METHODOLOGIES IN EIA 9 hours

Introduction - Elements of EIA - Factor affecting EIA -Impact evaluation and analysis - Preparation of Environmental Base map - Classification of environmental parameters. Criteria for the selection of EIA Methodology - EIA methods: Ad-hoc methods - matrix methods - Network method - Environmental Media Quality Index Method -overlay methods - cost/benefit Analysis.

UNIT II IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

Introduction and Methodology for the assessment of soil and ground water - Delineation of study area - Identification of actives. Procurement of relevant soil quality - Impact prediction - Assessment of Impact significance -Identification and Incorporation of mitigation measures. EIA in surface water - Air and Biological environment.

UNIT III IMPACT ON VEGETATION AND WILD LIFE 9 hours

Assessment of Impact of development Activities on Vegetation and wildlife - environmental Impact of Deforestation - Causes and effects of deforestation.

UNIT IV ENVIRONMENTAL AUDIT 9 hours

Environmental Audit & Environmental legislation objectives of Environmental Audit - Types of environmental Audit - Audit protocol - stages of Environmental Audit - onsite activities - evaluation of audit data and preparation of audit report - Post Audit activities.

UNIT V ENVIRONMENTAL POLLUTION ACTS 9 hours

The water Act-1974 - The Air Act-1981 (Prevention & Control of pollution Act.) - Wild life Act- 1972 - Indian Forest Conservation Act-1980 -National Green Tribunal Act –2010 - Biological Diversity Act-2002.

Course Outcomes:

The students after completing the course will be able to:

1. Apply the various methods used in predicting environmental impacts.
2. Apply site information to interpret impacts on land and groundwater.
3. Evaluate environmental impacts of various development activities on existing ecosystem.
4. Apply the procedures and various protocols involved in preparation of environmental audit report.
5. Apply the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books:

1. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B.S. Publication, Sultan Bazar, Kakinada.

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers
2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication, New Delhi.
3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CE303 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect in watershed management, quantification of water quality and quantity at the catchment outlet using modern techniques, drought, flood and storm management at catchment scale.

Course Objectives:
1. To discuss various aspects of water resources development and management on watershed basis.
2. To proliferate the sustainable use and development of natural resources.
3. To enrich the students for change in the hydrological fluxes due altered physiographic condition (land use or elevation) on a watershed scale.
4. To improve the quantitative problem solving skills of the students for natural resources management.

UNIT I CONCEPT OF WATERSHED 9 hours

Concept of watershed - classification of watershed - introduction to watershed management - objective of watershed development - Hydrological cycle - water balance equation - different stakeholders and their relative importance - watershed management policies and decision making. Factor Affecting Watershed Development**:** Morphological characteristics: linear - Arial and Relief aspect - land use - vegetation - soil and geological characteristics - Hydrology and geology and socio-economic characteristics.

UNIT II WATERSHED MODELING 9 hours
Watershed delineation - modelling of rainfall - runoff process - Concept of integrated watershed management conjunctive use of water resources - Integrated water resources management. PRA - Private sector participation - Institutional issues - Socio- economy issues - Integrated development - Water legislation and implementations - Tools and emerging technologies for watershed management and planning.

UNIT III EROSION AND SEDIMENTATION 9 hours
Types of erosion - factor affecting erosion - effect of erosion on land fertility and capacity - estimation of soil loss due to erosion: universal soil loss equation - Prevention And Control To Erosion: contour techniques - ploughing - furrowing- trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure.

UNIT IV WATER HARVESTING 9 hours
Rain water harvesting - catchment harvesting - harvesting structures - soil moisture conservation - check dams - artificial recharge from pond - percolation tanks - Flood And Drought Management: Definition of flood - Flood frequency analysis: Weibul - Gumbel - and log Pearson methods - Definition and classification of drought - drought analysis techniques - drought mitigation planning - Management Of Water Quality: Water quality and pollution - types and Sources of pollution - water quality modelling- environmental guidelines for water quality.

UNIT V COVER MANAGEMENT 9 hours
Land use land cover change estimation through satellite imageries - land capability classification - management of forest - agricultural - grassland and wild land - Reclamation of saline and alkaline soil. Classification of columns based on slenderness ratio - reinforcement & loading - Design of rectangular

and circular columns subjected to axial load - (axial load + uni-axial bending) and (axial load + bi-axial bending). Different Types of Footings - Design of isolated - square - rectangular and circular footings. Integrated Cropping System For Watersheds: Intercropping - mix cropping strip and terrace cropping - sustainable agriculture - cover cropping (biomass conservation) - horticulture - dryland agriculture and afforestation.

Course Outcomes:

The students after completing the course will be able to:

1. Classify watershed and Identify factors to consider for watershed Development.
2. Apply the concepts of watershed development and planning
3. Evaluate the erosion rate and total amount of soil loss from a watershed
4. Select the flood and drought mitigation measures
5. Quantify the change in land use land/cover and its impact on hydrological processes.

Text Books:

1. Kenneth N. Brooks Peter F. Ffolliott Joseph A. Magner. Hydrology and the Management of Watersheds. A John Wiley & Sons, Inc., Publication (4th Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To comprehend the various electrical and electronic properties of materials.
4. To understand origins and various types of magnetism and its applications.
5. To comprehend the transmission of light in various solids and study of photonic behavior.

UNIT I STRUCTURE OF MATERIALS 9 hours

Introduction: Historical prospective - importance of materials - Classification of Materials and its Properties. Bonding in solids: bonding forces and energies - primary and secondary bonding. Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure – miller indices, Linear and planar densities - close- packed crystal structures. Packing of atoms in solids. Packing factor

UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours

Crystal Imperfections: Types, Vacancies and interstitials, Dislocations, and grain boundaries. Diffusion: Fick's Law of diffusion – Diffusion mechanism – Steady state and non-steady state, factors affecting diffusion.

UNIT III ELECTRICAL PROPERTIES OF MATERIALS 9 hours

Introduction and Electrical Conduction: Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction - Energy Band Structures in Solids, Electron Mobility - Electrical Resistivity of Metals Semi conductivity: Intrinsic and Extrinsic Semiconduction - Temperature Dependence of Carrier Concentration, Factors that Affect Carrier Mobility, The Hall Effect, Semiconductor Devices. Conduction in Ionic Materials, Electrical Properties of Polymers. Dielectric Materials: Capacitance, Ferroelectric Materials, Piezoelectric Materials.

UNIT IV MAGNETIC PROPERTIES OF MATERIALS 9 hours

Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Anti ferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity.

UNIT V PHOTONIC MATERIALS 9 hours

Introduction, Electronic Radiation in Vacuum; Reflection, Refraction, and absorption in materials; Absorption and Chemical Bonding: Color, X-Ray absorption, Photon absorption Devices - Photon Emission: X-Ray Emission, Emission of electromagnetic radiation and devices: LED's, OLEDs and LASERs. Optical Fibers in communication

Course Outcomes:

At the end of the course students will be able:

1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials
2. To demonstrate knowledge of various imperfections in crystal, and diffusion mechanism in materials
3. To explain the origins of various electronic and electrical properties in the materials

4. To understand the concept of magnetism, its origin and types, while choosing the right material for the given application
5. To summarize various optical properties of the material and light's transmission behavior

Text Books:

1. W. Callister, "Materials Science and Engineering", Wiley, 7th Edition, 2007.
2. Charles M. Gilmore, "Materials Science and Engineering Properties", Cengage Learning, SI Edition, 2016

Reference Books

1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Cengage Learning, 5th Edition, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

Students belonging to all branches of Engineering are made to learn following fundamental topics related to mechanical engineering:

1. To teach students the basic concepts of Thermodynamics.
2. To teach students the basic Classification and working principles of boilers and turbines.
3. To teach students about IC engines, Refrigeration, and Air-Conditioning systems.
4. To teach students about engineering materials and casting manufacturing processes.
5. To teach students and machines tools and manufacturing systems.

UNIT I THERMODYNAMICS 9 hours

Basic concepts of Thermodynamics: Introduction, Important terminologies used in thermodynamics, Specific heat capacity, First law of thermodynamics, Second law of thermodynamics, Reversible and irreversible processes, the Carnot cycle and the Clausius inequality.

UNIT II BOILERS, TURBINES AND PUMPS 9 hours

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles, and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

UNIT III IC ENGINES AND REFRIGERATION SYSTEMS 9 hours

Internal Combustion Engines: Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle. Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

UNIT IV MATERIALS, CASTING AND TRANSMISSION 9 hours

Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.

Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.

Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.

UNIT V TOOLS AND MANUFACTURING SYSTEMS 9 hours

Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.

Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control.

Course Outcomes:

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

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Books:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

Reference Books

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

UNIT I ELECTRICAL SYSTEM COMPONENTS 9 hours

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9 hours

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III ILLUMINATION SYSTEMS 9 hours

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

UNIT IV INDUSTRIAL SUBSTATION SYSTEMS 9 hours

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V INDUSTRIAL SYSTEM AUTOMATION 9 hours

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Course Outcomes:

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

1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.
3. https://www.bis.gov.in/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:

1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I INTRODUCTION 9 hours

Overview – History and industry perspectives – Working principles – Mechanics and dynamics –– Scaling law

UNIT II MICRO SENSORS & ACTUATORS 9 hours
Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING 9 hours
Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS 9 hours
Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS 9 hours
Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:
Upon successful completion of the course, students will be able to

1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. Analyze the Micro sensors and actuators and its fabrication.
3. Explain the materials for MEMS and Microsystems.
4. Design MEMS using microfabrication techniques.
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Books:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, “An introduction to Micro electro mechanical system design”, ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2000.
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CST301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101, 20CSE102

Course Description:
Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, and input/output management.

Course Objectives:

1. To understand the basic concepts and functions of operating systems
2. To understand Processes and Threads
3. To analyze Scheduling algorithms
4. To understand the concept of Deadlocks
5. To analyze various memory management schemes
6. To understand I/O management and File systems

UNIT I OPERATING SYSTEMS OVERVIEW 9 hours

Operating system overview: Objectives – functions - Computer System Organization-Operating System Structure - Operating System Operations- System Calls, System Programs.

UNIT II PROCESS MANAGEMENT 9 hours
Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication. Process Synchronization: The Critical-Section Problem - Semaphores - Classic Problems of Synchronization – Monitors. Case Study: Windows 10 operating system

UNIT III SCHEDULING AND DEADLOCK MANAGEMENT 9 hours
CPU Scheduling: Scheduling Criteria - Scheduling Algorithms. Deadlocks: Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock. Case Study: MAC operating system

UNIT IV STORAGE MANAGEMENT 9 hours
Main Memory: Swapping - Contiguous Memory Allocation, Segmentation, Paging. Virtual Memory: Demand Paging - Page Replacement - Allocation of Frames - Thrashing. Case Study: Android operating system

UNIT V MASS STORAGE MANAGEMENT 9 hours
Mass Storage Structure: Disk Structure - Disk Scheduling - Disk Management. File-System Interface: File Concepts, Directory Structure - File Sharing – Protection. File System. Case Study: Linux operating system

Course Outcomes:
Upon successful completion of the course, students will be able to

1. Understand operating system program, structures and operations with system calls.
2. Apply the process management concept for real time problems
3. Illustrate CPU scheduling algorithms and to handle the deadlock for the given situation.
4. Explain the concepts of various memory management techniques
5. Summarize the storage concepts of disk and file.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley and Sons Inc., 2020.
2. Richard Petersen, “Linux: The Complete Reference”, 6th Edition, Tata McGraw-Hill, 2008

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CSE301 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

Pre-requisite: **None**

Course Description:
Basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java-classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:
1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
3. To Introduce the implementation of packages and interfaces.
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

UNIT I INTRODUCTION TO OOPS CONCEPTS AND CLASSES 9 hours

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements.
Classes: Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, Polymorphism
Arrays: One Dimensional and multi-dimensional arrays.

UNIT II STRINGS, INHERITANCE, INTERFACES, AND PACKAGES 9 hours
Strings: Strings, String Handling - Inheritance: Basics, Usage of Super, Multi-level hierarchy, Method overriding, Abstract class, Final keyword. - Interfaces: Creating, Implementing, Using, Extending, and Nesting of interfaces - Packages: Defining, Finding and Importing packages, Member Access.

UNIT III EXCEPTION HANDLING &MULTI-THREADING 9 hours
Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.
Multi-threading: Thread Class, Runnable interface, creating multiple threads, life cycle of thread, thread properties, synchronization, thread communication, suspending, resuming and stopping threads.

UNIT IV I/O STREAMS AND COLLECTION FRAME WORK CLASSES 9 hours
I/O Streams: Byte Stream Classes and Character Stream Classes.
Collection Frame work : Hierarchy of collection framework, Array-List, Linked-List, Vector, Stack, Queue, Priority Queue, Hash Set, Linked Hash Set, Tree Set.

UNIT V GUI PROGRAMMING AND EVENT HANDLING 9 hours
Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Event Handling-Handling mouse and keyboard events, Exploring Swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables. JDBC: Connecting to Database, querying a database and processing the results, updating data with JDBC.

Course Outcomes:

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

1. Choose object-oriented programming concepts for problem solving.
2. Create and use packages and interfaces.
3. Develop multithreaded applications with synchronization.
4. Provide computed based solutions by using java collection framework and I/O classes.
5. Design GUI based applications.

Text Books:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books

1. Core Java Volume I – Fundamentals, by Cay S. Horstmann, Gary Cornell Pearson Education Ninth Edition
2. “Java Fundamentals - A Comprehensive Introduction”, Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
3. “Java – How to Program”, Paul Deitel, Harvey Deitel, PHI.
4. “Thinking in Java”, Bruce Eckel, Pearson Education.
5. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20CSE302 MULTIMEDIA TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course aims to introduce the students to Multimedia technologies and their usage in real world applications. This course covers introduction to multimedia, different image, video and audio formats, image coding and compression techniques, I/O technologies, Multimedia network and Multimedia Security and Forensics.

Course Objectives:
1. To provide the foundation knowledge of multimedia technologies.
2. To provide the knowledge about media characteristics, compression standards, multimedia representation, data formats, multimedia technology development.
3. To understand Multimedia security and forensics.
4. To understand multimedia components efficiently
5. To develop integrated, collaborative multimedia systems

UNIT I INTRODUCTION 9 hours

Introduction to Multimedia: Multimedia Elements – Multimedia applications – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Multimedia Architecture – Multimedia Documents

UNIT II COMPRESSION, ANIMATION , FILE FORMATS 9 hours
Compression, Decompression, Binary Image Compression Schemes, Types of Compression, Image Compression, Video Compression, Audio Compression. Principles of animation, 2D, 3D animation.
File formats: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format.

UNIT III MULTIMEDIA TECHNOLOGIES 9 hours
Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images – Full Motion Video -Video Motion Analysis.

UNIT IV MULTIMEDIA PROTOCOLS 9 hours
Protocol - QOS Issues - RTP, RTCP, RTSP, SIP - Media on demand –ITV - STB Broadcast Schemes for VoD Buffer Management- Multimedia over wireless networks.

UNIT V SECURITY ATTACKS 9 hours
Multimedia encryption - Digital Watermarking. Security Attacks- Digital Forensics taxonomy, goals/requirements - Forensic Data Acquisition -Forensics Analysis and Validation.

Course Outcomes:

Upon completion of this course, students should be able to

1. Understand the characteristics of different media and the representations of different multimedia data formats.
2. Understand the characteristics of Image, Audio and Video systems and takes into considerations in multimedia techniques design and implementation.
3. Describe different coding and compression principles and compare different compression techniques.
4. Design multimedia components efficiently
5. Develop integrated, collaborative multimedia system

Text Books:

1. Li, Ze-Nian and Mark S. Drew, “Fundamentals of Multimedia”, Prentice Hall of India, 2004.

2. Steinmetz Ralf and K. Nahrstedt “Multimedia: Computing, Communications & Applications”,Pearson Education, 1995.

Reference Books

1. Ralf Steinmetz and Klara, “Multimedia Computing, Communications and Applications”, Pearson Education, 2009
2. Chun-Shien Lu, “Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property”, Springer Inc 2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

Open Elective - IV

20PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS 8 hours

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES 10 hours

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS 8 hours

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films.

UNIT IV CHARACTERIZATION OF THIN FILMS 10 hours

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS 9 hours

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

Course Outcomes:

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

1. Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
2. Asses the relation between deposition technique, film structure, and film properties.
3. Know the typical thin film applications.
4. Motivate selection of deposition techniques for various applications.

Text Books:

1. Thin Film Deposition: Principles and Practice, Donald L. Smith, McGraw Hill, Singapore, 2001.
2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / Kasturi L. Chopra, New York: McGraw-Hill, c1969.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
3. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
4. Thin film processes, John L Vossen, Werner Kehn editors, Academic Press, New York, 1978.
5. Thin film physics / O.S. Heavens, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Course Objectives:

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems

UNIT I MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY 8 hours

History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology. Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in crystals.

UNIT II TYPES AND SYNTHESIS OF NANOSTRUCTURES 10 hours

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Nanoscale building blocks, Top-down and Bottom-up approaches. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Co-precipitation, Emulsion Polymerization (Polymer and Organic NPs), Sol-Gel, Green synthesis of Nanoparticle (NP).

UNIT III PROPERTIES OF NANOMATERIAL 8 hours

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Nanocomposites, Semiconductors). Carbon age materials: CNTs, and other Carbon-based materials). Effect of size and shape on the properties of nanomaterials.

UNIT IV CHARACTERIZATION OF NANOMATERIALS 10 hours

Structure: Powder XRD (SAXS); Composition: XPS; Thermal: TG-DTA; Optical & Electron microscopes: Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID).

UNIT V APPLICATIONS OF NANOMATERIALS 9 hours

Molecular electronics and nano-electronics – LED applications, Quantum electronic devices - CNT based transistor and Field Emission Display – Biological (anti-bacterial, anti-fungal, anti-microbial) applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system.

Course Outcomes:

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

1. Understand the correlation between atomic, molecular structures and nanomaterials
2. Classify the types and synthesis the nanomaterials based on the needs of the society and environment.
3. Infer and interpret the properties of nanomaterials
4. Apply the knowledge of characterization tools towards making the sustainable engineering products.
5. Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Text Books:

1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

Reference Books

1. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
2. K. E. Drexler, Nano systems, Wiley, 1992.
3. G. Cao, Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperical College Press, 2004.
4. P. Yang, Chemistry of Nanostructured Materials, World Scientific Publishers, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Exposure to Introductory engineering mathematics, introductory materials science and introductory programming courses is preferred.

Course Description:
This course deals with various computational approach and mathematical methods to understanding and apply different concepts in materials science and engineering.

Course Objectives:

1. To get exposed to the basic concepts in Materials Science and Engineering.
2. To understand the basic concepts of Programming and Graphical plotting.
3. To introduce the basic concepts of Data types and handling of various data.
4. To familiarize the basic concepts of modelling and simulation.
5. To acquire and apply the current knowledge and trends in the field of Computational Materials Science.

UNIT I INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING 9 hours
Concepts in materials science and engineering; use of computers and freely available open source software to: data handling; understand concepts and solve problems of engineering interest.

UNIT II PROGRAMMING AND PLOTTING 9 hours
Introductions to the advanced concept C programming language; open source software for numerical computations and visualization (gnuplot, GNU Octave, Scilab); introduction to the LaTeX software for report preparation along with other miscellaneous software and programs.

UNIT III DATA TYPES AND HANDLING TECHNIQUES 9 hours
Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration.

UNIT IV COMPUTATIONAL MODELING AND SIMULATIONS 9 hours
Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO.

UNIT V CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE 9 hours
Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project.

Course Outcomes:

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

1. Understand the importance and applications of computational methods in Materials Science and Engineering.
2. Be familiarized with the tools of the trade, namely programming and graphical plotting.
3. Be able to understand and access the various types of data sets and appropriately handle it to productively work with it.
4. Get the knowledge about handling various open source computational tools and their effective usage to do computational modeling and simulations.
5. Be familiarized with up to date trends in computational materials science by taking up real time research problems and provide solutions.

Text Books:

1. Computational Materials Science: An Introduction, Second Edition 2nd Edition, by June Gunn Lee, 2014
2. Materials science and engineering: an introduction, William D Callister, Sixth edition, John Wiley & Sons, 2013.
3. The C programming language, Brian W Kernighan and Dennis M Ritchie, Second edition, PHI Learning Private Limited, 2010.
4. Materials science and engineering: a first course, V Raghavan, Fifth edition, PHI Private Limited, 2008.
5. Physical metallurgy principles, Robert E. Reed-Hill, Second edition, Affiliated East-West Press Pvt. Limited, 2008.
6. An introduction to materials science and engineering, Kenneth M Ralls, Thomas H Courtney, and John Wulff, Wiley India Pvt. Ltd., 2011.

Reference Books

1. Materials Science and Engineering,V Raghavan,Prentice-Hall India, 2004
2. Advanced Engineering Mathematics, E Kreyzig, Wiley-India,1999.
3. A Review of Computational Methods in Materials Science, International Journal of Molecular Sciences 10(12):5135-216

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CE304 GREEN BUILDINGS AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course covers various aspects of bioclimatic architecture like climate sensitive design, passive solar architecture, Water management, green building materials and construction techniques.

Course Objectives:

1. The course introduces concepts of sustainability and bioclimatic design in planning, construction and life of buildings.
2. This course intends to equip students with technical knowledge of energy-efficient green buildings
3. This course guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. This course also initiates students in basics of functional design and drawing of the various buildings using the above concepts.

UNIT I GREEN BUILDING CONCEPTS 9 hours

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing - Building regulations and bylaws - Traditional and VernacularArchitecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction - various steps in Site planning - Plan form Building envelope Land form -Topography - vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

Calculation of thermal conductance - Heat flow through different building elements - Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones.

Course Outcomes:

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

1. Use various regulations and by laws for green building construction0.
2. Do site planning for Green Building.
3. Compute thermal flow through different building elements
4. Identify energy efficient building materials
5. Compute cost of building/operation and maintenance

Text Books:

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw- Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol. II). New Delhi: The Energy and Resources Institute(TERI) Press.

Reference Books

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press.
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan. Building Design and Drawing. Calicut: Spades Publishers, 2008.
5. Szokolay, S. V. (2008). Introduction to Architectural Science - The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier.
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press.
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing,New Delhi, CharotharPublishing House

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course covers demand, quality and treatment of water along with characterization, water and wastewater treatment plant units and design , low cost treatment of wastewater and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives:

1. To explain different sources of water, water quality standards, water demands, distribution of water, population forecast, characteristics of water.
2. To analyze various water treatment plant units and their design considerations, advanced water treatment systems.
3. To explain the generation and collection of wastewater; wastewater treatment plant design, various wastewater treatment units and sludge treatment.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management techniques

UNIT I WATER SUPPLY ENGINEERING 9 hours

Water- Sources of Water, Water quality standards, Quantity of water: water demands, percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and distribution of water; Quality of water: Physical, chemical, and biological characteristics of water and significance, necessity of treatment, water quality standards for various water uses.

UNIT II WATER TREATMENT 9 hours
Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection; Methods of treatment: Removal of color, tastes and odor control, removal of iron and manganese, fluoridation and defluorination. Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only.

UNIT III WASTEWATER TREATMENT 9 hours
Generation and collection of wastewaters- sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system. Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation. Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended growth systems, Attached growth systems, Secondary clarification, Disinfections of effluents; Sludge treatment and disposal: Sludge characteristics, thickening, disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours
Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement, and various noise control methods.

UNIT V SOLID WASTE MANAGEMENT 9 hours
Solid waste management-Municipal solid waste, Composition, and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment, and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:
At the end of the course, students will be able to:
1. Estimate water demand and population forecasting and characteristics of water
2. Estimate water generation and perform basic design of the unit operations that are used in water treatment plants.
3. Explain various wastewater generation sources and different units of wastewater treatment and sludge treatment techniques
4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods
5. Discuss about the impacts of solid waste and various solid waste management techniques

Text Books:

1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers.
2. Rao M and Rao H. V. N. Air Pollution, McGraw Hill Education, 2017.
3. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009
4. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

Reference Books

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
3. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
4. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20ME303 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. TQM encompasses various principles, techniques, and tools for identifying and solving problems, fostering a culture of quality, promoting teamwork, and striving for excellence in all areas of the organization. The goal of TQM is to achieve sustainable and long-term success by consistently delivering high-quality products and services that meet or exceed customer expectations while improving overall organizational performance.

Course Objectives:

Students will

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and Failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. Facilitate the understanding of standards of quality.

UNIT I INTRODUCTION 9 hours

Introduction - Evolution of Quality - Historical Perspective, Basic Concepts of Quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran, Crosby and Feigenbaum – Dimensions of product and service quality

UNIT II TQM PRINCIPLES 9 hours

TQM principles - Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection,

UNIT III TOOLS OF TQM 9 hours

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – KAIZEN, 5S, JIT, Documentation – Failure mode and Effect Analysis (FMEA)

UNIT IV TQM TECHNIQUES 9 hours

Quality circles – Quality Function Deployment (QFD) – House of Quality – Design of Experiments – Taguchi quality engineering – Orthogonal Arrays – Signal to Noise Ratio – TPM – Concepts, improvement needs – Cost of Quality – Performance measures

UNIT V IMPELMENTATION OF TQM 9 hours

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards –Implementation – Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001, Case studies on TQM principles followed by Indian Industries.

Course Outcomes:

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

1. Understand the various principles and practices of TQM to achieve quality.
2. Identify the various statistical approaches for Total Quality Control.
3. Demonstrate the TQM tools for continuous process improvement.
4. Adopt the importance of ISO and Quality systems.
5. Make use of the concepts of TQM to solve case studies

Text Books:

1. Dale H. Besterfield, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

Reference Books

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006) Model.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20ME304 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

This course is designed to ignite the entrepreneurship idea into the young minds of engineers. This course gives the complete details to setup an enterprise which includes the generating business ideas, writing business plan and executing the plan successfully.

Course Objectives:

1. Understand the requirements of entrepreneurship as a profession.
2. Understand and develop the business plan.
3. Identify the various financial terms and conditions of new business venture.
4. Selection of plant location and choosing layout.
5. Analyse the market research for new ventures and small businesses.

UNIT I INTRODUCTION 9 hours

Introduction to Entrepreneurship, history of entrepreneurship development, social Entrepreneurship, Intrapreneurship, Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision processes. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Realities & Case studies about successful Entrepreneur

UNIT II CREATING AND STARTING THE VENTURE 9 hours

Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, implementation of business plans. Case studies of successful business plan, Marketing plan, financial plan, and organizational plan, Launching formalities. Developing business plan and evaluation with team.

UNIT III FINANCING AND MANAGING THE NEW VENTURE 9 hours

Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. Ecommerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Case studies about entrepreneur who success or failure in their business based on the financial control

UNIT IV PLANT LAYOUT 9 hours

Definition of plant layout and its types, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance. Case study about selection of site and plant layout for new business venture.

UNIT V MARKET ANALYSIS AND PROJECT MANAGEMENT 9 hours

Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Case studies on market analysis on entrepreneur perspective. Project Organization- Project Planning, Monitoring, Control and Learning. Detailed life cycle and post-mortem analysis, Resource allocation, Risk and uncertainty, Budget constraints, Project feasibility.

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Describe the sources of new business ideas, methods to develop new ideas and use the problem-solving techniques.
2. Write a business plan which includes financial plan, organizational plan and marketing plan.
3. Identify the financial sources for new business ventures.
4. Select a plant layout and draw a plant layout.
5. Design a workplace and analyse the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

Reference Books

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – IV

20EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Pre-requisite Nil 20EEE108

Course Description:

Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting areas for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:

This course enables students to

1. To know the fundamentals of Robotics & its applications.
2. To know about sensors and make them to handle the selection of sensors for robot design.
3. To know about kinetic and Jacobian modelling.
4. To know about robot programming and implementation.

UNIT I INTRODUCTION, TRANSFORMATION AND MAPPING 9 hours

Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects.

Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9 hours

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers.

Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9 hours

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors, binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS 9 hours

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems.

UNIT V ROBOT PROGRAMMING, IMPLEMENTATION AND ECONOMICS 9 hours

Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs. RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand the fundamentals of Robotics.
2. Analyze the robot drive system.
3. Understand the various sensors and actuators.
4. Analyze the mechanical structure and notations kinematic model.
5. Implement the basic commands for robots.

Text Book(s)

1. Mittal, R. K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
4. Pugh, A., Robot Sensors, Vision Vol.-I. Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill,

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective – IV

20EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Pre-requisite Nil 20EEE101

Course Description:

To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:

This course enables students to

1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I ELECTRICAL HAZARDS 9 hours

Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, Classification of insulating materials, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one-line diagram-electrician's safety kit.

UNIT II GROUNDING AND BONDING 9 hours

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 Ground resistance measurement using megger.

UNIT III SAFETY METHODS 9 hours

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.

UNIT IV SAFETY TEAM 9 hours

Electrical safety programme structure, development- company safety team- safety policy-programme implementation- employee electrical safety teams- safety meetings- safety audit-accident prevention-first aid- rescue techniques-accident investigation.

UNIT V MAINTENANCE OF ELECTRICAL EQUIPMENT 9 hours

Safety related case for electrical maintenance- reliability centred maintenance (RCM) - eight-step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- Indian standard for electrical safety in work place- occupational safety and health administration standards.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Book(s)

1. Dennis Neitzel, Al Winfield, 'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

Reference Books

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.

2. The Institution of Electric Engineers, 1994.

3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

4. Tareev, 'Electrical Engineering Materials', Verlag Technik, Berlin

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

20CSE303 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course is concerned with the development of applications on Android platform. Android is used as a basis for the development of mobile applications. This course starts with the basic concepts of Java, history of android and architecture. It introduces the major building blocks that are used to develop an android application with examples. It also covers the development of applications using widgets, events, networking. It provides ideas on sensors, their types and writing programs based on sensor classes for application development.

Course Objectives:

This course enables students to

1. Understand Android history and its fundamentals and know the building blocks of android
2. Get idea on the creation of android user interface and its testing mechanisms
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology
4. Know about the storage mechanism in android using SQLite and the usage of content providers
5. Recognize the usage of android widgets and sensors in android based applications

UNIT I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS — 9 hours

Android Overview – History – Android Versions - Android Flavors. Android Stack: Linux, Native Layer and Hardware Abstraction Layer (HAL) – ART - Application Framework: Native C++ Library – Applications: System and User Applications - Installation and Use of Android Tools: Installing the Android SDK - Anatomy of an Android Project - Drawable Resources – XML Introduction - Creating user interface using XML – Overview of Android Building Blocks – Logging Messages in Android

UNIT II USER INTERACTION — 9 hours

Example. Input Components – Text View – Image View – List View and Alert Dialogues – Menus: Popup, Options and Context Menus – Screen Navigation through App Bar – Recycler View – Material Design – Testing the User Interface: Expresso – Screen Navigation using Intents: Definition – Usage of Intends – Creation of Indents with example program – Lists and Adapters – Types of Adapters – Examples using Adapters

UNIT III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES — 9 hours

Threading in Android – AsyncTask – Loaders – AsyncTask Loader – Connecting to Internet: JSON - HTTP API, Apache HTTP Client, HTTP URL Connection - Broadcast Receivers: Custom Broadcasts – Broadcasting Intends and their related API - Boot Receiver - Alarms and system services – Examples on alarms and services – Services: Services Life Cycle – Intent Service – Implementing Intent Service – Notifications: Managing Notifications

UNIT IV SAVING, RETRIEVING AND LOADING DATA 9 hours

Android File systems and Files - Action Bar: Preferences and Action Bar - Shared Preferences – App Settings - Databases on Android - SQLite - Status Contract Class, Update Refresh Service – Cursors – Backups - Content Providers: Overview – Role of Content Providers - - Content Provider Example Program – Content Resolver

UNIT V APPLICATIONS WIDGETS, INTERACTION AND SENSORS 9 hours

App Widgets: Creation of Application Widgets - Interaction and Animation: Live Wallpaper and Handlers - Sensors: Sensor API in Android - Motion Sensor, Position Sensor, Environmental Sensor, Sensor Values, Sensor Manager Class, Sensor Class, Sensor Event class, Sensor Event Listener interface, Compass Accelerometer and orientation Sensors, Sensor Examples.

Course Outcomes:

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

1. Work on android basic components and Install android
2. Create User Interfaces with various Layouts and views using android building blocks
3. Work with Broadcast Receivers and Services
4. Create Database in Android, Store and Retrieve data using SQLite and Content Providers
5. Develop widgets, Wall papers for an android application and write programs based on Sensors

Text Book(s)

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition
2. Android Programming for Beginners, John Horton, PACKT publishers
3. Learning Android , By Marko Gargenta & Masumi Nakamura, O'Reilly, II Edition
4. Android Application Development All in One for Dummies, Barry Burd, Wiley, 2nd Edition

Reference Books

1. Android application Development-Black Book, Pradeep Kothari, dreamtech
2. Android Programming - Unleashed, B.M.Harwani, Pearson Education, 2013
3. Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths and David Griffiths, O’Reilly, 2nd Edition
4. Android System Programming, Roger Ye, PACKT publishers
5. Programming Android, By Zigurd Mednieks, Laird Dornin, G.Blake Meike & Masumi Nakamura, O'Reilly

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

20CSE304 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite 20CSE115

Course Description:

Software Project Management is generally seen as a key component of successful software projects. Together with software techniques it can produce software of high quality. This course deals with the decisions and actions related to planning, organizing, leading, and controlling programs and projects. Students are expected to gain a comprehensive understanding of Strategy, organization and leadership in managing projects and understanding of Processes, methods and systems used to plan, schedule and monitor projects.

Course Objectives:

This course enables students to

1. To understand the basic concepts and issues of software project management.
2. To understand successful software projects that support organization's strategic goals.
3. Develop the skills for tracking and controlling software deliverables.
4. Understand and assess the cost of risk involved in a project management
5. Understand the various software management tools.

UNIT I SPM CONCEPTS 9 hours

Definition – components of SPM – challenges and opportunities – tools and techniques – managing human resource and technical resource – costing and pricing of projects – training and development – project management techniques.

Agile Methodology: Theories for Agile Management-Agile Software Development-Traditional Model Vs Agile Model-Classification of Agile Methods-Lean Production-SCRUM.

UNIT II SOFTWARE MEASUREMENTS 9 hours

Monitoring & measurement of Software development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects.

UNIT III SOFTWARE QUALITY 9 hours

Quality in Software development – quality assurance – quality standards and certifications – the process and issues in obtaining certifications – the benefits and implications for the organization and its customers – change management.

UNIT IV RISK ISSUES 9 hours

The risk issues in Software development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management.

UNIT V SPM TOOLS 9 hours

Software project management using Primavera & Redmine - Case study on SPM tools.

Course Outcomes:

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

1. Maintain software projects and monitor software project process

2. Design and develop project modules and assign resources

3. Understand software quality and project management techniques

4. Comprehend, assess, and calculates the cost of risk involved in a project management

5. Use Primavera & Redmine software management tools.

Text Book(s)

1. Richard H. Thayer, "Software Engineering Project Management", John Wiley & Sons, 2ndEdition-2001

2. Royce, Walker, "Software Project Management", Pearson Education, 2002 4. Kelker, S. A., "Software Project Management", Prentice Hall, 2003

Reference Books

1. Software Project Management, Bob huges, Mike cotterell, Tata McGraw Hill, New Delhi,2002.

2. Software Project Management: A Concise Study, S. A. Kelkar, PHI.

3. Software Project Management, Joel Henry, Pearson Education.

4. Software Project Management in practice, Pankaj Jalote, Pearson Education.

5. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

20CST302 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite -

Course Description:

This course will cover a top-down view of cloud computing, from applications and administration to programming and infrastructure. The aim is to provide skills and knowledge about operations and management in cloud technologies and design cloud infrastructure to meet the business needs.

Course Objectives:

1. To learn the design and development process involved in creating a cloud-based application.
2. To implement and use parallel programming using various tools.
3. To learn Various service models such as IaaS and PaaS and deployment models such as private, public, hybrid, and community.
4. To provide skills to design suitable cloud infrastructure that meets the business services and customer needs.
5. To identify various security and privacy issues in cloud.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9 hours

Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architectures

UNIT II SERVICE DELIVERY AND DEPLOYMENT MODELS 9 hours

Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) – Software as a Service(SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud – Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management.

UNIT III VIRTUALIZATION 9 hours

Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations

UNIT IV CLOUD COMPUTING: APPLICATIONS AND PARADIGMS 9 hours

Existing Cloud Applications and Opportunities for New Applications - Architectural Styles for Cloud Applications - Workflows: Coordination of Multiple Activities - Coordination Based on a State Machine Model: The ZooKeeper - The Map Reduce Programming Model - A Case Study: The GrepTheWeb Application

UNIT V CLOUD PLATFORMS AND SECURITY 9 hours

Comparing Amazon web services, Google AppEngine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models. Cloud application development using third party APIs, Working with EC2. Security Clouds

Course Outcomes:

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

1. Understand the evolution, principles, and benefits of Cloud Computing in order to assess existing cloud infrastructures to choose an appropriate architecture that meets business needs.
2. Decide a suitable model to capture the business needs by interpreting different service delivery and deployment models.
3. Understand virtualization foundations to cater the needs of elasticity, portability and resilience by cloud service providers.
4. Infer architectural style, workflow of real-world applications and to implement the cloud applications using map reduce programming models.
5. Design a cloud framework with appropriate resource management policies and mechanism

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1st Edition, 2013.
2. Dongarra, Jack, Fox, Geoffrey, Hwang, Kai,"Distributed and Cloud Computing",.1st Edition, Morgan Kaufmann, 2013.
3. Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.

Reference Books:

1. Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering Cloud Computing: Foundations and Applications Programming, Tata Mcgraw Hill, 1st Edition, 2017.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Mc Graw Hill Education, 1st Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

Open Elective - V

20HUM301 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives:

The course is intended to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us;

2. Know the concepts of planning and management;

3. Explain the basic concepts of organization, types and structure of organization;

4. Make the students know leading, good communication, theories of motivation; and

5. Explain controlling, operations management, value chain management and management audit.

UNIT I INTRODUCTION 9 hours

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment, - Social Responsibility and Managerial Ethics.

UNIT II PLANNING 9 hours

Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management.

UNIT III ORGANIZING 9 hours

Organizational structures - HRM process, Contemporary issues in HRM – Departmentation – decentralization – delegation of Authority - Managing Change and Innovations.

UNIT IV COMMUNICATION, MOTIVATION AND LEADING 9 hours

Functions of communication, Inter-personal communication, Barriers of Communication – Understanding Information Technology- Motivation**:** Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership issues in twenty first century

UNIT V CONTROLLING 9 hours

Process of Control – Problems of Control Process-Types of Control – Techniques of Control-Essential conditions for effective control- Contemporary issues in control – Strategic role of Operations Management - Value Chain Management.

Management Audit: Objectives-Importance-Activities of Management Auditor.

Course Outcomes:

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

1. Understand the various concepts, approaches and theories of management in the real situation,

2. Analyze the concept of planning and apply on the decisions in strategic management,

3. Compare organization structure designs and chart diligently with theoretical learning concepts,

4. Apply communication and theories of motivation in an organization, and

5. Understand various tools for controlling organizational performance, management audit and apply to achieve the corporate objectives.

Text Book(s)

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10th edition.

2. P. Subba Rao "Management and Organizational Behavior", Himalaya Publishing House.

Reference Books

1. Gary Dessler, "Management", Prentice Hall, Inc., 1998, 1st edition.

2 Daft Richard L. 'Management' Thomson South Western, 5th edition.

3 Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6th edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

20HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:
The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives:
The course is intended to:
1. Explain the nature and scope of HRM, its functions, policies and strategies;
2. Describe the human resource planning, work analysis and importance in designing jobs;
3. Know the recruitment, selection and the process of performance appraisal;
4. Make the student to learn about training and development, compensation management and
5. Explain the trade unions, industrial relations and grievance.

UNIT I INTRODUCTION 9 hours

Understanding the nature and scope of Human Resource Management- Definition, Evolution of HRD, Functions - objectives, organization of department. Human Resource Management v/s Personnel Management, Role and responsibility of HRM.

UNIT II HUMAN RESOURCE PLANNING 9 hours
Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

UNIT III RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL 9 hours
Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

UNIT IV TRAINING AND DEVELOPMENT 9 hours
Meaning – importance and benefits of Training and Development, Training v/s Development – Training Methods - challenges in training - Career development: Definition-objectives—importance of career development – Reward Management – Compensation Management: Nature-Objectives-Components of Compensation- Theories of Compensation-Factors influencing employee compensation.

UNIT V INDUSTRIAL RELATIONS, TRADE UNIONS 9 hours
Trade Unions: Importance-Objectives- Functions and Structure of the Trade Unions- Trade Union movement in India- Industrial Relations: Nature--Importance- Approaches-essential conditions for sound IR. Industrial Disputes: Meaning – Types- Causes-Industrial disputes settlement machinery. Grievance: Sources and Process of Redressal,

Course Outcomes:

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

1. Understand the concept of HRM, its nature, scope, functions, policies and strategies;
2. Analyse human resource planning and apply in designing jobs;
3. Evaluate the recruitment, selection and the process of performance appraisal;
4. Understand the importance of training and development activities, compensation management and
5. Examine the trade unions, industrial relations and grievance.

Text Book(s)

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010

2. Gomez-Mejia, L.R., Balkin, D.B., & Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.

3 VSP Rao, Human Resource Management-Text & Cases, Excel Books.

Reference Books

1. Garry Dessler, BijuVarkkey , Human Resource Management ,11th Edition, Pearson Education, 2009.

2 R. Wayne Mondy, Human Resource Management, 10th Edition, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

20HUM303 SOFT SKILLS

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

Soft skills are the personal attributes that make a student a valuable employee and a wholesome personality. They include aspects like communication, teamwork, problem-solving, and time management. Employers are increasingly looking for employees with strong soft skills, as they are essential for success in the workplace. This course will help students analyze themselves and build soft skills needed for their personal and career success.

Course Objectives:

The course is intended to:

1. Analyze their strengths and skills, and build confidence in presenting themselves
2. Work seamlessly as a team and negotiate for solutions
3. Think laterally and critically to evaluate a situation and present it with clarity
4. Write business emails effectively
5. Prepare holistically for a job interview

UNIT I SELF ANALYSIS AND DEVELOPMENT 10 hours

Personal ethics (politeness, empathy, and honesty); self-motivation / building confidence and assertiveness; identifying one's unique selling points (USPs) through skills introspection and recognizing strengths and weaknesses; nurturing strengths and fixing weaknesses; self-introduction.

UNIT II TEAM WORKING AND DYNAMICS 12 hours

Brainstorming techniques, team building, collaboration, and negotiation skills; team role plays (involving negotiation and decision making); group discussion etiquette (greetings and body language), idea generation, and common GD phrases; group discussion practice

UNIT III THINKING AND REASONING SKILLS 6 hours

Lateral thinking, critical thinking and logical reasoning through texts, images, and videos; Speaking activities (e.g. JAM) involving lateral thinking and reasoning through thought-provoking pictures, videos, cartoons, comic strips or articles.

UNIT IV PRESENTATION SKILLS 7 hours

Presentation etiquette; slides design; and presentation practice.

UNIT V INTERVIEW SKILLS 10 hours

Preparing resume and cover letter for job interviews; interview etiquette: dress code, body language, tone, and greeting; HR interviews: answering common interview questions, practice for HR interviews.

Course Outcomes:

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

1. Understand and express themselves with confidence
2. Work as an active team member
3. Think and express their views logically and speak on varied topics without hesitations.
4. Prepare business presentations and emails effectively
5. Attend job interviews with confidence

Text Book(s)

1. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.

2. Archana Ram, PlaceMentor, 2018, Oxford University Press

Reference Books

1. Karen Kindrachuk, Introspection, 2010, 1st Edition

2 Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at work, 2011, Berrett-Koehler Publishers

3. Colin Swatridge, Oxford Guide to Effective Argument and Critical Thinking 1st Edition, Oxford University Press

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

20HUM304 NATIONAL CADET CORPS

L	T	P	C
3	0	0	3

Pre-requisite: NCC B-Certificate

Course Description:
The main aim of this course is to mould the youth into responsible citizens of the nation. It helps to improve character and leadership qualities towards nation building. This course also motivates the youth to offer Selfless service to the society and nation. The course comprises Common subjects, Service subjects of NCC, societal aspects and basic organization of Indian Armed Forces.

Course Objectives:
This course enables the student to –

1. Get aware of NCC organization and general structure of Defence Forces.
2. Learn leadership and national integration.
3. Motivate towards to maintain Health and hygiene, personality development.
4. Learn elementary characteristics of disaster management, Field craft and Battle craft.
5. Acknowledge the Social activities, Communication and Military History.

UNIT I **10 hours**

INTRODUCTION TO NCC
Introduction, History of NCC , NCC Motto, NCC Flag, Aims of NCC, Cardinal points of NCC, Organization of defence forces in general, Organizational structure of Indian Army(Armed forces), Organizational structure of NCC, NCC Song, Incentives of NCC, Ranks in Army, Navy and Air Force, current representatives – Certificate Examination in NCC– Honours and Awards.

FOOT DRILL BASICS
Aims of Drill, Word of Commands, Attention, Stand at Ease, Turning Left, Right and Inclining at the Halt. Sizing, Forming up in three Ranks and Numbering, Open and Close March Order, Dressing the Squad, Saluting at the Halt, Getting on Parade, Falling Out and Dismissing, Marching, Guard of Honour.

UNIT II **10 hours**

LEADERSHIP
Meaning, Leadership Traits, Types of Leadership, Discipline & Duty of an Indian Citizen, Motivation, Code of Ethics, Perception, Communication, Customs of Services, Importance of Team Work, leaders(swami Vivekananda).

NATIONAL INTEGRATION
Meaning and Importance, Unity in Diversity, Indian History and Culture, Religion and Customs of India, India and its Neighbours, Contribution of Youth in Nation Building, Contribution of leaders in nation unification .

UNIT III **12 hours**

HEALTH AND HYGIENE
Structure and Function of Human Body, Hygiene and Sanitation, Preventable Diseases, First Aid, Yoga: Introduction and Exercises, Physical and Mental Health, Fractures: Types and Treatment.

PERSONALITY DEVELOPMENT
Introduction to personality development, Physical and social factors influencing / shaping personality, psychological and philosophical factors influencing / shaping personality, Self-awareness, SWOT analysis, mind set, interpersonal relationship and communication, effective communication, barriers of communication.

ENVIRONMENT AND ECOLOGY
Environment: Meaning, Global Warming, Acid Rain, Depletion of Ozone Layer, Conservation of Environment. Ecology: Introduction, Component of Ecological System, Forest Ecology, Wild Life, Pollution Control.

UNIT IV **10 hours**
DEFENCE AND DISASTER MANAGEMENT
Civil Defence: Meaning, Organization and its Duties, Civil Defence Services, Fire Fighting : Meaning, Mode of Fire, Fire Fighting Parties, Fire Fighting Equipment. Introduction, Classification of Disaster: Natural Disaster & Man Made Disaster, Disaster Management During Flood, Cyclone and Earth Quake, Assistance in Removal of Debris, Collection and Distribution of Aid Material, Message Services.
SOCIAL SERVICE ACTIVITIES (Social Service And Community Development)
Basics of Social Service, Weaker Sections in the Society and its Identification, Contribution of Youth towards Social Welfare, NGOs and their Role and Contribution , Social Evils, Drug Abuse, Family Planning, Corruption, Counter Terrorism, Eradication of Illiteracy – Aids Awareness programme – Cancer Awareness Programme.

UNIT V **10 hours**
COMMUNICATION
Types of communication, characteristics of wireless technology, Walkie/talkie, Basic RT procedure, Latest trends and development(Multimedia, video conferencing, IT)
MILITARY HISTORY
Biography of Indian Historical Leaders: Chatrapati Shivaji, Maharana Pratap, Akbar Famous Battles / Wars of India: Indo – Pak War 1971(all wars), Kargil War.(Categorise: before/ After independence)
Biography of Successful Leaders: General Patton, General Mac. Arthur, Field Marshal Sam Maneksha.

Course Outcomes:
At the end of the course, students will be able to:
1. Analyse the NCC structure and different ranks in Indian Armed Forces along with foot drill.
2. Notify the leadership traits and the need of national integrity towards nation building.
3. Instill respect and responsibility towards personal health and hygiene, develop dynamic personality with adequate qualities.
4. Identify different disasters and judging measurements on the ground.
5. Recognise various communication devices, analyse the Military Organization.

Text Books:
1. HAND BOOK OF NCC – “SANJAY KUMAR MISHRA, MAJOR RC MISHRA”, published by Kanti prakashan-2020.
2. NCC HAND BOOK - “SHASHI RANJAN & ASHISH KUMAR”, published by Goodwin Publications-2021.

Reference Books:

1. NCC Hand book – “R.Gupta’s”, Ramesh Publishing House-2021.
2 NCC (ARMY WING)- “R.Guptas’s”,RPH Editorial Board-2021
3 Hand Book Of N.C.C. – “Ashok Pandey”, Kanti Publications-2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Professional Elective - I

Professional Elective – I

20ECE401 NANO ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103, 20ECE108**

Course Description:
This course provides an overview of Semiconductor Physics and carrier transport phenomenon. It illustrates Quantum Mechanics, Nano-materials, Nanoscale MOSFET Transistors and their characteristics.

Course Objectives:
This course enables students to
1. Apply the knowledge of Quantum physics to illustrate energy band structure.
2. Understand the basic physics of Kronig-Penney Model.
3. Understand the fundamentals of operation of the semiconductor electronic devices and their characteristics.
4. Understand the band theory of solids and concept of scaling.
5. Understand the features of nanomaterials for electronics device applications

UNIT I INTRODUCTION 9 hours

Introduction to nanotechnology, meso-structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States.

UNIT II BAND THEORY 9 hours
Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

UNIT III SHRINK-DOWN APPROACHES 9 hours
Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

UNIT IV NANO DIODES 9 hours
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics.

UNIT V APPLICATIONS 9 hours
Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Understand various aspects of nano-technology and energy band structure of nanomaterials.
2. Understand the fundamental features of nano-materials and appropriate use in solving practical problems.
3. Understand the operation of semiconductor devices.
4. Understand the band theory of solids and concept of scaling for designing of semiconductor devices.
5. Understand the various applications of nanomaterials.

Text Book(s)

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.

Reference Books

1. K.E. Drexler, Nano systems, Wiley, 1992.

2. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

3. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley,2003

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – I

20ECE402 ELECTRONICS PACKAGING AND TESTING

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103**

Course Description:

This course gives the fundamental overview of electronic systems packaging, issues in packaging, chip packages, surface mount technology and thermal effect.

Course Objectives:

This course enables students to

1. Know the basic concepts, levels, and applications of Electronic Systems Packaging.
2. Understand the electrical issues in electronic packaging.
3. Study and understand the steps involved in designing chip package.
4. Understand the different levels of manufacturing in PCB
5. Understand the various physical issues considered in testing the chip

UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9 hours

Functions of an electronic package, Packaging hierarchy, Packaging aspects of handled products- MEMS packaging, Medical electronics packaging, Packaging trends and challenges, Driving forces on packaging technology, Materials for Microelectronic packaging, Packaging material properties, Material for high density interconnect substrate, Wafer fabrication.

UNIT II ELECTRICAL ISSUES IN PACKAGING 9 hours

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitic.

UNIT III CHIP PACKAGES 9 hours

IC Assembly – Purpose and requirements, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn - in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System - in - package (SIP); Passives: discrete, integrated, and embedded.

UNIT IV PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9 hours

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation - Cooling requirements.

UNIT V TESTING 9 hours

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue, Thermo mechanically induced, electrically induced, and chemically induced failures. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

Course Outcomes:

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

1. Understand the basic concepts and applications of Electronic Systems Packaging
2. Know the electrical issues in electronic packaging.
3. To analyze and test the electronic system in packages.
4. Understand the surface mount technology and their thermal consideration.
5. Develop system level electrical testing.

Text Book(s)

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.

2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.

Reference Books

1. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.

2. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

3. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – I

20ECE403 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103, 20ECE106**

Course Description:

This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:

This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

Course Outcomes:

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

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Book(s)

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"HandbookofBiomedicalInstrumentation",2ndedition,TataMcGraw-Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – I

20ECE404 ADVANCED DIGITAL SYSTEM DESIGN USING VERILOG HDL

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102**

Course Description:

The course will provide advanced knowledge on combinational and sequential design using Verilog HDL. The course covers theory and methods to develop expertise in the field of Digital Logic Design using Verilog. Student will understand application of advanced digital logic designs in FPGAs and analyze the behaviour through Verilog HDL programming.

Course Objectives:

This course enables students to

1. Understand the digital design methodology, and revise the combinational and sequential logic concepts.
2. Program combinational and sequential logic circuits using Verilog HDL.
3. Synthesize combinational and sequential logic circuits.
4. Understand FPGA architectures.
5. Design digital logics in FPGAs

UNIT I COMBINATIONAL AND SEQUENTIAL LOGIC DESIGN 9 hours

Digital Design Methodology; Combinational Circuits: Half Adder, Full Adder, Comparators, Decoders, Encoders, Multiplexers, Parity Generators and Checkers; Data Storage Elements: Latches, Flip-Flops, Register, Memory, ROM, RAM; Sequential Circuits: State Representations, Timing in Sequential Circuits, Shift Registers, Counters.

UNIT II LOGIC DESIGN WITH VERILOG 9 hours

Introduction to Verilog; Gate Level Modelling, Data Flow Modelling, Behavioural Level Modelling, Switch Level Modelling; Digital system design using Verilog HDL.

UNIT III SYNTHESIS OF COMBINATIONAL AND SEQUENTIAL LOGIC USING VERILOG 9 hours

Introduction to Synthesis: Logic Synthesis, RTL Synthesis, High Level Synthesis; Synthesis of Combinational Logic: Synthesis of Priority Structure, Exploiting Logical Don’t-Care Conditions, ASIC Cells and Resource Sharing; Synthesis of Sequential Logic: Synthesis of Latches, Flip-flops, State Machines.

UNIT IV INTRODUCTION TO FPGA ARCHITECTURES **9 hours**

Overview, Programming Technologies, Configurable Logic Block, FPGA Routing Architectures.

UNIT V DESIGNING WITH FPGA 9 hours

Design Flow for FPGAs, Prototyping with FPGAs, and Debugging.

Course Outcomes:

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

1. Design a combinational and sequential circuits.
2. Understand the basics of Verilog and can design any combinational and sequential circuits using Verilog HDL.
3. Understand the different Synthesis methods and can synthesize the combinational and sequential circuits.
4. Understand the different FPGA architectures.
5. Implement any digital system on FPGA

Text Book(s)

1. Michael D. Ciletti, "*Advanced Digital Design with Verilog HDL*", PHI, 2005

2. T. R. Padmanabhan and B. Bala Tripura Sundari, "*Design through Verilog HDL*", WSE, IEEE Press, 2004.

Reference Books

1. Cem Unsalan, Bora Tar, "*Digital System Design with FPGA: Implementation Using Verilog and VHDL*", ISBN: 9781259837906, McGraw Hill Publications.
2. Shivakumar S. Chonnad and Needamangalam B. Balachander, "*Verilog: Frequently Asked Questions: Language, Applications, and Extensions*", ISBN: 978-0387228341, Publisher: Springer, 2007.
3. Simon Monk, "*Programming FPGAs-Getting Started with Verilog*", ISBN: 978- 1259643767, McGraw Hill Publications. ISBN: 978-0982497098, LBE Books.
4. Steve Kilts, "*Advanced FPGA Design: Architecture, Implementation, and Optimization*", ISBN: 9780470054376, Publishers: Wiley, 2007
5. Richard C. Dorf and John V. Oldfield, "*Field-Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems*" ISBN: 9788126516612, Publisher: Wiley, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – I

20ECE405 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE107**

Course Description:
The course will provide strong foundation on embedded system design. The course covers theory and logic to develop programming expertise. Student will understand application of embedded microcontrollers ARM.

Course Objectives:
This course enables students to

1. To provide knowledge on the basics, building blocks of Embedded System.
2. To provide basic of operating system and Real time programming languages
3. To teach automation using scheduling algorithms and Real time operating system.
4. To understand firmware design and Architectural Support for Operating Systems for various applications
5. To discuss on different Phases & Modeling of a new embedded product.

UNIT I THE CONCEPT OF EMBEDDED SYSTEMS 9 hours

Embedded System Design, Introduction to Embedded Hardware Elements, Sensors and Actuators, Embedded Processors, Memory Architectures. Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories, Embedded microcontroller cores

UNIT II SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I 9 hours

Operating System Basics, types of Operating Systems, Task and Task States, Semaphores and shared Data, RTOS services and design using RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Real time programming languages.

UNIT III SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II 9 hours

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS, Integrated Development Environment (IDE).

UNIT IV FIRMWARE AND ARCHITECTURAL SUPPORT FOR OPERATING SYSTEMS 9 hours

Firmware and Bootloader, an introduction to operating systems, The ARM system control coprocessor Embedded ARM Applications, CP15 protection unit registers, CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/Output, Example and exercises, The ARM7500 and ARM7500FE.

UNIT V MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES 9 hours

Modelling embedded systems- embedded software development approach -Overview of UML modelling with UML, UML Diagrams-Hardware/Software Partitioning, Co-Design Approaches for System Specification and modelling- Co-Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures-design approach on parallelism in uniprocessors & Multiprocessors.

Course Outcomes:

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

1. To understand the functionalities of processor internal blocks, with their requirement
2. Understand the basics of operating systems and then to learn the programming language used for real time operating system.
3. systems and related terms.
4. Understand the role and features of RT operating system, that makes multitask execution possible by processors.
5. Understand that using multiple CPU based on either hard-core or softcore helps data overhead management with processing.

Text Book(s)

1. M.A. Mazdi & J.G. Mazdi, The 8051 Microcontroller and Embedded System, Pearson Education India , 2013

2. Andrew N. Sloss & Dominic Symes, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publisher, 2004.

Reference Books

1. Steve Furber, Arm System-On-Chip Architecture, 2000.

2. J.K. Peckol, Embedded Systems A contemporary Design Tool, Wiley Student Edition , 2008

3. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram International Publishing (India)

4. S. Heath, Embedded Systems Design, Elsevier, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - III

Professional Elective – III

20ECE406 FIBER OPTIC COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE109, 20ECE105, 20PHY102**

Course Description:

This course discusses the communication fundamentals related to fiber optic communication. It discusses in details about the transmitters, receivers and related components in details. Students are exposed to learn key terms including lasers, LEDs, Photodetectors bandwidth etc. Furthermore, this course deals with the channel multiplexing in optical communication systems. In this respect, architectural aspects of such systems, the optical components needed for their implementation, and the performance issues such as nonlinear effects are discussed in detail.

Course Objectives:

This course enables students to

1. Expose the students about the fundamental of optical communication
2. Enable the students to understand various signal distortion and dispersion compensation techniques in optical fiber
3. Introduce the advanced features of Transmitters, Receivers, Switches and Amplifiers
4. Classify the various optical components and networks of the optical fiber
5. Analyze the various nonlinear effects of the optical fiber.

UNIT I OVERVIEW OF OPTICAL COMMUNICATION 9 hours

Introduction, The general optical fiber communication system, advantages of the optical fiber communications. Optical fiber waveguides: Introduction, Ray theory transmission, Total Internal reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical Fiber modes. Fiber materials, Fiber fabrication techniques, fiber optic cables, Classification of Optical fibers: Single mode fibers, Graded Index fibers.

UNIT II SIGNAL DISTORTION IN OPTICAL FIBERS 9 hours

Attenuation, Scattering, Absorption and Bending losses, Core and Cladding losses. Information capacity determination, Group delay, Types of Dispersion: Material dispersion, Waveguide dispersion, Polarisation mode dispersion, Intermodal dispersion, pulse broadening. Optical fiber connectors: Connector types, Connector return loss.

UNIT III OPTICAL TRANSMITTER 9 hours

Optical sources: Intrinsic and extrinsic material-direct and indirect bandgaps LEDs, LEDs structures-Surface emitting LED, Edge emitting LED, LED-Quantum efficiency, and LED power-light source materials-modulation of LED,LASER diodes-modes and threshold conditions, Rate equations, External Quantum efficiency, resonant frequencies, structure and radiation patterns-single mode laser, external modulation, temperature effects

UNIT IV OPTICAL DETECTORS AND RECEIVER 9 hours

Physical principles of PIN and APD, Detector Response Time, Temperature effect on Avalanche gain, Comparison of photodetectors. Optical receiver operation-Fundamental receiver operation, Digital signal transmission error, sources, Receiver configurations.

UNIT V OPTICAL COMPONENTS AND NETWORK 9 hours

Optical components: Optical switches-Types, Optical couplers-Types, coupled mode analysis of directional couplers, Optical Amplifier-EDA and Raman Amplifier. Elements of optical network: WDM and DWDM network-Principle and Components, SONET/SDH.

Course Outcomes:

After completing this Unit, students will be able to

1. Acquire the knowledge on the basics of optical communication system, properties of light, understand the principles transmission properties of optical fiber, its components, bandwidth advantages and various losses.
2. Understand the operation of lasers, LEDs, and detectors, their performance in presence of noise.
3. Analyze and compare various optical couplers, switches and amplifiers.
4. Understand the principle of WDM and DWDM, SONET/SDH light wave systems.
5. Analyze the nonlinear effects in optical fiber and understand their mechanism relevant to WDM systems.

Text Book(s)

1. Martin Sibley," Optical Communications Components and Systems",Springer,2020.
2. Ivan Kaminov, Tingye Li, Alan E.Wilner, "Optical Fiber Telecommunications VI B Systems and Networks", Elsevier 2014.
3. D. K Mynbaev, S C Gupta, and Lowell L. Scheiner, "Fiber Optic Communications", Perason Education, 2005.

Reference Books

1. G. Keiser, "Optical fiber communication systems", McGraw-Hill, New York, 4th edition, 2011.
2. Franz & Jain, "Optical communication, Systems and components", Narosa Publications, New Delhi, 2000.
3. J. Gowar, "Optical communication systems", Prentice Hall India, 1987.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – III

20ECE407 SOFTWARE FOR EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite : **20ECE107**

Course Description:

This course provides students to an introduction of embedded system design, design methodologies and modelling with Synthesis Software and Hardware. It also provides an exposure to Real-time system design, Rapid Object -Oriented Process for Embedded System along with UML, and RTUML Profile

Course Objectives:

This course enables students to

1. Remember: Recall and recognize the fundamental concepts and components of embedded systems.
2. Understand: Comprehend the systems design methodology and modeling techniques used in embedded systems.
3. Apply: Apply synthesis software and hardware tools to design and develop embedded systems.
4. Analyze: Analyze real-time systems and different design approaches to address timing constraints and system performance.
5. Evaluate: Evaluate the effectiveness of the Rapid Object-Oriented Process for Embedded Systems (ROOPES), UML, and RTUML Profile in the development of embedded systems.

UNIT I INTRODUCTION 9 hours

Introduction to embedded systems and their applications, Types of embedded systems: custom single-purpose processors, Hardware, software for single purpose processors and general-purpose processors, Peripherals-Memory Interfacing, Design considerations for a digital camera embedded system.

UNIT II SYSTEM DESIGN METHODOLOGIES AND MODELLING 9 hours

Overview of system design methodologies: bottom-up, top-down, middle, platform-based, FPGA architecture and its role in embedded systems, Processor synthesis, State-based models, Finite state machine. Programming languages commonly used in embedded systems design, Embedded software development tools.

UNIT III EMBEDDED SYSTEM AND SYNTHESIS 9 hours

Overview of synthesis techniques in embedded systems design, Target languages for embedded system development, Software synthesis flow: code generation and optimization techniques, System-C, Multi-task synthesis and Hardware Synthesis design flow, High-level synthesis (HLS) for hardware design in embedded systems. RTL design process and HDL(VHDL/Verilog). Test standards for embedded system

UNIT IV REAL-TIME SYSTEMS AND DESIGN APPROACHES 9 hours

Introduction to real-time operating systems (RTOS) and their features, Design considerations for real-time operating systems, periodic, aperiodic and sporadic tasks, Precedence constraints and dependencies. Scheduling, Hard real time scheduling, Techniques for optimizing memory space and power consumption in real-time systems, Task and their states, Semaphores and shared data, Message queues, mailboxes and pipes, Event function. Real-time embedded system

UNIT V RAPID OBJECT-ORIENTED PROCESS AND UML FOR EMBEDDED SYSTEMS **9 hours**

Rapid Object-Oriented Process (ROOP) for embedded systems development, Introduction to Unified Modelling Language (UML) and its role in system design, RT UML profile, UML profile for schedulability, performance, Design methodologies of UML for embedded systems. Security consideration for Embedded system.

Course Outcomes:

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

1. Knowledge: Demonstrate understanding of embedded systems and their designs.
2. Comprehension: Explain design methodologies, modeling techniques, FPGA architecture, and programming languages used in embedded systems.
3. Application: Apply programming skills to write software and implement it in hardware for embedded systems.
4. Analysis: Analyze real-time systems and evaluate different design approaches to meet timing requirements and optimize system performance.
5. Evaluation: Evaluate and compare different tools available for developing and debugging embedded systems.

Text Book(s)

1. Simon, David E., "An Embedded Software Primer," Addison-Wesley Professional, 2005.
2. Douglass, Bruce Powel, "Real-Time UML," Pearson Education, 3rd Edition, 2004.

Reference Books

1. Daniel D. Gajski, Specification and Design of Embedded Systems Pearson (2008).
2. Jane Liu, Real-Time Systems, Pearson ed., 2009.
3. Frank vahid, Tony Givargis Wiely Embedded System design. (Reprint 2009.)
4. J Bhasker, A System-C primer, Star galaxy publishing. 2010.
5 Zurvsk, Taylor&Francis, Networked embedded systems hand book.
6 Daniel P Bovet, OReilly, Understanding the Linux kernel 3rd Edition 2005

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – III

20ECE408 WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite : **20ECE 113**

Course Description:

This course provides the fundamental aspects of analysis of wireless channel and MIMO system. It incorporates Cellular structure, fading channels, adaptive equalization and diversity techniques, BER performance analysis of AWGN and Rayleigh fading channel, OFDM and MIMO techniques.

Course Objectives:

This course enables students to

1. Learn the evolution of wireless communication and cellular concepts
2. Understand the characteristic of wireless fading channel, Equalization and Diversity.
3. Study the performance of various wireless fading channel.
4. Know the MIMO wireless system and OFDM technique.
5. Explore OFDM technology in wireless communication.

UNIT I EVOLUTION OF WIRELESS COMMUNICATION AND CELLULAR CONCEPTS 9 hours

Evolution of mobile communications (1G to 5G), Multiple Access techniques: FDMA, TDMA, CDMA, Cellular concept, Frequency reuse, channel assignment, hand off, Capacity calculations, interference & system capacity, trunking & grade of service, Coverage and capacity improvement.

UNIT II CHARACTERISTICS OF WIRELESS CHANNEL, UALIZATION AND DIVERSITY 9 hours

Wireless propagation mechanism, Large scale path loss, Path loss models: Free Space, small scale fading, Factor affecting of Small scale fading, Time dispersion parameters, Coherence bandwidth, Doppler spread & Coherence time, fading due to Multipath time delay spread, flat fading, frequency selective fading, Fading due to Doppler spread, fast fading, slow fading, Rayleigh fading Channel, Fundamentals of Equalization, Adaptive equalization, Linear and Non-Linear equalization, Diversity Techniques: Spatial Diversity, Selection Diversity, Frequency diversity and Time diversity.

UNIT III PERFORMANCE ANALYSIS OF WIRELESS FADING CHANNEL 9 hours

Structure of wireless communication system model, Rayleigh fading channel, AWGN channel, BER analysis of AWGN channel, Error performance over Rayleigh fading channels, performance comparison of AWGN and Rayleigh fading Channel.

Wireless System Planning: Free Space Propagation Model, Ground - Reflection Scenario, Okumura Model, Hata Model, Log normal Shadowing, Receiver Noise Computation, Link Budget Analysis

UNIT IV ORTHOGONAL FREQUENCY -DIVISION MULTIPLEXING (OFDM) 9 hours

Motivation and Multicarrier Basics - Multicarrier Transmission, Cyclic Prefix in OFDM, Impact of Cyclic Prefix on Data Rate, Example, BER for OFDM system, MIMO-OFDM, Drawbacks in OFDM - Peak to Average Power Ratio (PAPR), Effect of Frequency offset in OFDM, SC-FDMA - Receiver, and Subcarrier Mapping in SC- FDMA.

UNIT V MIMO WIRELESS SYSTEM 9 hours

Introduction to MIMO systems, MIMO System model, spatial multiplexing, Pre-coding, MIMO Beam forming, transmitter diversity, receiver diversity, Channel state information, capacity in fading and non- fading channels, OFDM based MIMO systems.

Course Outcomes:

After completing this Unit, students will be able to

1. To illustrate the evolution of wireless communication and cellular concepts
2. Characterize wireless fading channels, various equalization and diversity techniques.
3. Compare the performance of AWGN and Rayleigh fading channels in terms of BER
4. Realize MIMO and OFDM techniques to improve system performance.
5. Relate of the concepts of OFDM technology in wireless communication.

Text Book(s)

1. Rappaport, T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
2. William Stallings., "Wireless Communication and Networks", Second Edition, Pearson Education, 2016.

Reference Books

1. Aditya K Jagannatham, "Principles of Modern Communication Systems - Theory and Practice," McGraw Hill Education, 2016
2. Andrea Goldsmith, ''Wireless communications", Second Edition, Cambridge University Press, 2005.
3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – III

20ECE409 FPGA BASED SYSTEM DESIGN

L	T	P	C
3	0	0	3

Pre-requisite Nil 20ECE102, 20ECE111

Course Description:

This course is designed to give knowledge and understanding of different technologies to implement digital computing systems. It also focuses on various FPGA architectures. It makes students to learn automated design flows which will in turn support FPGA based designs. This course also entails basics of FPGA design tools.

Course Objectives:

This course enables students to

1. Gain the knowledge and understanding of different technologies for the implementation of digital computing systems.
2. Interpret the FPGA architectures.
3. Know Automated design flows supporting designs with FPGAs.
4. Analyze the fundamentals of the FPGA design tools.
5. Develop knowledge of logic implementation for FPGA's.

UNIT I DESIGN WITH FPGA 9 hours

Digital IC design flow- Architecture of ROM – ROM Programming – Architecture of SPLDs – SPLDs programming – Architecture of CPLDs- The role of FPGAs in digital design – Goals and techniques – Hierarchical design-CAD Tools.

UNIT II FPGA ARCHITECTURES 9 hours

FPGA architectures – Configurable logic blocks - configurable I/O blocks – Programmable Interconnect-Partitioning and Placement, Routing Resources– clock circuitry – Xilinx FPGA architecture – Programming Technologies: Antifuse, SRAM, EPROM, EEPROM.

UNIT III VERILOG HDL 9 hours

HDL overview - Modules and ports - compiler directives - data types - operands and operators - gate level modelling - data flow modelling - behavioural modelling – switch level modelling – Primitives- Tasks and functions - Writing test bench.

UNIT IV DIGITAL SYSTEM DESIGN 9 hours

Data path Designs-Adders, Multipliers, Comparators, Shifter, Multiplier, Arithmetic and Logic unit - Flip Flops, Memory unit Building a Data path, Sequential circuit control, pipelined data path and design of main control unit, Design of Serial Adder using FSM, Design of Sequence Detector.

UNIT V LOGIC IMPLEMENTATION FOR FPGA 9 hours

Combinational network delay - syntax directed translation - logic implementation by macro - logic synthesis - logic optimization - sequential machine design: rules for clocking, performance analysis - physical design for FPGAs: placement, routing -Testing. Design examples: Traffic light controller, score board and controller, keyboard scanner and controller.

Course Outcomes:

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

1. Exemplify the significance of FPGAs in ASIC design flow.
2. Learn the architectures and programming technologies of various FPGAs.
3. Learn the programming in Verilog hardware description language.
4. Model and implement different digital computing systems in FPGAs.
5. Access the concepts of back end design in FPGA platform.

Text Book(s)

1. Wayne Wolf, "FPGA-Based System Design", Prentice Hall, New Delhi, 2012.
2. Samir Palnitkar, "Verilog HDL: A guide to digital design and synthesis" Pearson Education India, 2010.
3. M.J.S. Smith, "Application Specific Integrated Circuits", Pearson, 2000.

Reference Books

1. ZainalabedinNavabi," Verilog Digital System Design", Tata McGraw Hill, New Delhi, 2010.
2. Roth and John," Principles of digital systems design", Cengage learning, 2010
3. Bob Zeidman, "Designing with FPGAs and CPLDs", CMP Publishers, 2002.
4. Bhasker J "A Verilog HDL Primer", BS Publications, 2007.
5. Ming-Bo Lin, "Digital System Designs and Practices: Using Verilog HDL and FPGAs", Willey Indian Edition, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective-III

20ECE410 COGNITIVE RADIO

L	T	P	C
3	0	0	3

Pre-requisite 20ECE109, 20ECE113

Course Description:

This course targets to discuss the cognitive radio and adaptive radio concepts from several aspects. The course describes the basics of the software defined radios. It provides comprehensive coverage of hardware and software architecture of software defined radio. This course covers the need of improving the spectrum efficiency and effective methods to achieve it.

Course Objectives:

This course enables students to

1. To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities.
2. To study the basic architecture and standard for cognitive radio.
3. To study the techniques of spectrum sensing and fundamental tradeoffs present in it.
4. To understand the fundamental issues regarding dynamic spectrum access and the radio-resource management.
5. To understand the terms spectrum trading, radio resource pricing and the applications of auction theory in context of cognitive radio.

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO AND COGNITIVE RADIO 9 hours

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

UNIT II COGNITIVE RADIO ARCHITECTURE 9 hours

Cognition cycle – orient, plan, decide and act phases, organization, SDR as a platform for cognitive radio – hardware and software architectures, overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III SPECTRUM SENSING 9 hours

Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, fundamental tradeoffs in spectrum sensing, geo-location database and spectrum sharing business models.

UNIT IV DYNAMIC SPECTRUM ACCESS AND MANAGEMENT 9 hours

Spectrum broker, centralized dynamic spectrum access, distributed dynamic spectrum access, fundamental limits of cognitive radio.

UNIT V SPECTRUM TRADING 9 hours

Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA, classification of auctions.

Course Outcomes:

At the end of this course, students will be able to
1. Understand the fundamental concepts of software defined radio and cognitive radio.
2. Know the basic architecture of cognitive radio.
3. Explain the techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
4. Understand the concepts of dynamic spectrum access techniques and the radio-resource management.
5. Understanding of the applications of auction theory as an economic approach to enable the emerging cognitive radio systems very useful.

Text Book(s)

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, "Cognitive Radio ommunications and Networks", Academic Press, Elsevier, 2010.
2. Ekram Hossain, Dusit Niyato, and Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
3. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", John Wiley & Sons Ltd., 2009.

Reference Books

1. Bruce Fette, "Cognitive Radio Technology" Elsevier, 2nd edition, 2009.
2. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
3. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - IV

Professional Elective – IV

20ECE411 PATTERN RECOGNITION AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite 20MAT109, 20ECE105

Course Description:

This course introduces the fundamental concepts, techniques, and applications of pattern recognition. The course will cover topics including statistical pattern recognition, machine learning, clustering, decision trees, neural networks, and their applications in computer vision, speech recognition, and natural language processing.

Course Objectives:

This course enables students to

1. Understand the fundamental concepts and techniques of pattern recognition
2. understand and utilize a wide range of supervised and unsupervised learning algorithms, including decision trees, artificial neural networks, support vector machines, clustering algorithms, PCA, SOM, convolutional neural networks (CNN), recurrent neural networks (RNN), and generative adversarial networks (GAN).
3. understand and apply structural pattern recognition techniques, in order to effectively analyze and recognize patterns in various domains such as natural language processing, computer vision, and speech recognition.
4. understand and effectively perform feature extraction and selection techniques in pattern recognition
5. Enable students to gain knowledge and skills in applying pattern recognition techniques to various real-world applications.

UNIT I INTRODUCTION: OVERVIEW OF PATTERN RECOGNITION AND ITS APPLICATIONS **9 HOURS**

Basic concepts and terminology; Application of pattern recognition; Introduction to supervised and unsupervised learning; Overview of machine learning algorithms and their role in pattern recognition.

UNIT II CONCEPT OF SUPERVISED AND UNSUPERVISED CLASSIFICATION **9 HOURS**

Supervised Learning Algorithms (Decision trees; Artificial neural networks; Support vector machines) Unsupervised Learning Algorithms (Clustering algorithms; Principal Component Analysis (PCA); Self-Organizing Maps (SOM); Deep Learning for Pattern Recognition (convolution neural networks (CNN); Recurrent Neural Networks (RNN); Generative Adversarial Networks (GAN)

UNIT III STRUCTURAL PATTERN RECOGNITION **9 hours**

Elements of formal grammar - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation.

UNIT IV FEATURE EXTRACTION AND SELECTION **9 hours**

Feature Selection- Outlier Removal - Data Normalization - Missing Data - Entropy minimization – Karhunen- Loeve transformation - Feature selection through functions approximation - Binary feature selection.

UNIT V APPLICATIONS OF PATTERN RECOGNITION- 9 hours

Description of the Digit Data and pre-processing of Data; Classification Algorithms Recent Advances Fuzzy logic; Computer vision; Speech recognition; Natural language processing; Graph Matching; Shape Analysis; Object Recognition; Text Recognition; Speech Recognition; Biometric Recognition; Pattern Classification and Perception.

Course Outcomes:

Upon completion of this course the students should be able to:

1. Understand and apply various algorithms for pattern recognition.
2. Realize the clustering concepts and algorithms.
3. Creating structural pattern recognition techniques.
4. Evaluating feature extraction techniques.
5. Developing an application using recently advanced algorithms.

Text Book(s)

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning” Springer, 2006
2. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, John Wiley & Sons, 2001.

Reference Books

1. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.
2. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York,1993.
3. Duda R.O., and Hart. P. E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
5. Aguado, Alberto S.; Nixon, Mark S, “Feature extraction and image processing for computer vision, Elsevier” Academic Press, 2020.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – IV

20ECE412 MOBILE COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite 20ECE113

Course Description:

This course provides the fundamental aspects of various mobile communication standards- GSM, GPRS, 3G CDMA, 4G and 5G. It provides detailed analysis of various access techniques, spread spectrum CDMA, and OFDM in mobile communication networks. It provides analysis on the implementation of Ad-hoc networks.

Course Objectives: The course enables the students to

1. Understand the basics of various Mobile Generation systems and cellular concepts.
2. Analyze the various multiple access techniques used in mobile communication networks.
3. Interpret the various equalization and diversity techniques.
4. Analyze the various mobile communication standards and GPRS networks.
5. Understand the mobile Ad-hoc networks and various wireless IEEE standards.

UNIT I CELLULAR MOBILE RADIO SYSTEMS 9 hours

Introduction-. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT II RADIO PROPAGATION & MULTIPLE ACCESS TECHNIQUES 9 hours

Mobile radio channels: Path-loss, slow-fading, fast-fading , delay spread and coherence bandwidth, flat fading and frequency selective fading, Multiple access techniques like Frequency division multiple access (FDMA), Time division multiple access (TDMA), Spread Spectrum, Code division multiple access (CDMA), OFDMA.

UNIT III EQUALIZATION AND DIVERSITY TECHNIQUES 9 hours

Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms; Handoff techniques: Diversity techniques: Selection Diversity, Scanning Diversity, Equal Gain Combining.

UNIT IV GSM AND OTHER MOBILE STANDARDS 9 hours

GSM services and features, system architecture, GSM radio subsystem, GSM channel types, location updating and call setup, GPRS and packet Architecture GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS , Application for GPRS, Limitation of GPRS, WAP , MMS, GPRS Applications, 3G W-CDMA; CDMA digital cellular standard, comparison between GSM and CDMA, 3G CDMA 2000, IMT-2000, 4G LTE-A and 5G

UNIT V ADHOC NETWORKS 9 hours

Cellular and Adhoc Wireless Network, Issues in Adhoc Wireless Network. MAC protocols: Introduction, issues, design issues, goals and classification. Contention based protocols with reservation, scheduling algorithms, protocols using direction antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Course Outcomes:

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

1. Understand the basics of various Mobile Generation systems and cellular concepts.
2. Select the apt multiple access techniques for specific application in mobile communication networks.
3. Interpret the various equalization and diversity techniques.
4. Analyze the various mobile communication standards and GPRS networks.
5. Understand the mobile Ad-hoc networks and various wireless IEEE standards.

Text Books

1. Rappaport, T.S "Wireless Communications", Second Editon, Pearson Education, 2010.
2. C. Shiva Rama Murty and B.S.Manoj, **"**Ad Hoc Wireless Networks: Architectures and Protocols" Second Editon, Pearson Education 2012.

Reference Books

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. S. Haykin & M. Moher, "Modern Wireless Communication", Pearson, 2005.
3. Vijay K Garg, "Wireless Communication and Networking", Elesevier, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – IV

20ECE413 RADAR ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite **20ECE108, 20ECE112**

Course Description:

The main objective of this course is to introduce students to the fundamental ideas in the field of radar communication. The various types of radar systems, the various navigational aids that are employed, and the fundamental construction of a radar transmitter and receiver will all be made clear to the students.

Course Objectives:

This course enables students to

1. Introduce the concept of radar and the basis equation
2. Expose the student to a variety radar transmission and detection system
3. Understand different types of tracking Radar and signals.
4. Familiarize the student with basis navigation Radar Systems.
5. Understand concepts of advanced Navigation Radar Systems.

UNIT I BASIC CONCEPTS AND RADAR EQUATIONS 9 hours

Introduction to radar, Radar Block diagram and Operation, Application of Radars, Radar Frequencies millimetre and sub millimetre waves, Radar equation, Range performance of radars, System losses and propagation effects.

UNIT II CW, FM CW AND MTI RADAR 9 hours

Introduction to MTI and Doppler radar: Delay Line canceller - Moving Target Detector- Pulse Doppler Radar-CW Radar – FMCW Radar- Multiple or staggered Pulse Repetition Frequencies, MTI radar Processor, Types of MTI.

UNIT III TRACKING RADAR 9 hours

Introduction to Tracking Radar, Types of tracking radars - Conical scan and Sequential lobbing, Monopulse Tracking, tracking in range, Automatic tracking with surveillance Radar (ADT).

UNIT IV RADAR CLUTTER AND BASIC NAVIGATIONAL RADAR SYSTEM 9 hours

Introduction to Radar Clutter, Types of Radar Clutter, Surface clutter radar equation, Four Methods of navigation, Radio direction Finding, Types of Radar Antennas, Automatic directional finders, VHF Omni directional Range (VOR).

UNIT V ADVANCED NAVIGATIONAL SYSTEM 9 hours

Hyperbolic system of Navigation, LORAN (Long Range Navigation), Decca navigation system, DME (Distance Measurement Equipment), TACAN (Tactical Air Navigation), Omega Navigation system, Navistar Global positioning system.

Course Outcomes:

After completing this Unit, students will be able to

1. Describe the radar fundamentals.
2. Describe the working of various radar transmitters and receivers.
3 Analyse the radar types and signals.
4. Describe the various navigation Radar Systems
5. Explain the concepts of advanced Navigation Radar Systems

Text Book(s)

1. G S N Raju, “Radar Engineering and Fundamentals of Navigational Aids” Wiley India Pvt Ltd, 2020.
2. Skolnik, M., "Introduction to Radar Systems", Tata McGraw-Hill, Third Edition, 2017.

Reference Books

1. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004.
2. Sen, A.K. & Bhattacharya, A.B. “Radar System and Radar Aids to Navigation”, Khanna Publishers, 1988.
3. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004.
4. N. S. Nagaraju, "Elements of Electronic Navigation Systems", Tata McGraw-Hill, Second Edition, 2000

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – IV

20ECE414 SPEECH AND AUDIO PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite **20ECE105**, 20ECE110

Course Description:

This course provides fundamental ideas of speech production and modelling, linear prediction of speech, speech quantization, LPC decoders and encoders. Also, it gives the insight idea about code excited linear prediction.

Course Objectives:

This course enables students to

1. Develop the knowledge of speech production and modelling
2. Describe the linear prediction of speech.
3. Distinguish the types of speech quantization.
4. Solve problems on Scalar Quantization of LPC.
5. Understand the speech-based applications.

UNIT I INTRODUCTION 9 hours

Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT II LINEAR PREDICTION OF SPEECH 9 hours

Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction

UNIT III SPEECH QUANTIZATION 9 hours

Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types

UNIT IV SCALAR QUANTIZATION OF LPC 9 hours

Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model

UNIT V SPEECH BASED APPLICATIONS 9 hours

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility, and naturalness – role of prosody, Speech Prosody, Speech Prosody Modelling Applications, and present status

Course Outcomes:

After completing this Unit, students will be able to

1. Develop the knowledge of Speech Production modelling and solve the Speech Signal processing.
2. Describes the linear prediction of speech.
3. Distinguishing the types of speech quantization.
4. Solving problems on Scalar Quantization of LPC.
5. Analyze the speech-based applications.

Text Book(s)

1. A.M.Kondoz, "Digital Speech", Wiley Students Edition, Second Edition, 2006.
2. W.C. Chu, "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", Wiley Inter Science, 2004.

Reference Books

1. Reddy, "Biomedical Signal Processing: Principles and Techniques", Tata McGraw Hill, Second edition, 2005.
2. Discrete-Time Speech Signal Processing: Principles and Practice by Thomas F. Quatieri, 2002.
3. Theory and Applications of Digital Speech Processing, by L. R. Rabiner and R. W. Schafer.2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – IV

20ECE415 DSP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite 20ECE110

Course Description:

The course will provide an insight into the architectures of DSP processors for handling the bottlenecks in executing DSP algorithms. On the application side the students can develop FPGA based DSP Systems and can understand the concept of multicore DSP as HPC infrastructure

Course Objectives:

This course enables students to

1. Understand the programmable digital signal processing hardware.
2. study the architecture of TMS320CX processor and block diagram
3. Know syntax and write the assembly language programming for digital signal processors.
4. Study the architecture of FPGA based DSP for various applications.
5. Study about High-Performance Computing using P-DSP.

UNIT I PROGRAMMABLE DSP HARDWARE 9 hours

Introduction: Digital signal-processing system, discrete Fourier Transform (DFT) and fast Fourier transform (FFT), differences between DSP and other microprocessor architectures. Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating-Point Computations, Special Architectures, Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

UNIT II STRUCTURAL AND ARCHITECTURAL CONSIDERATIONS 9 hours

Parallelism in DSP processing, Commercial digital Signal-processing Devices, Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, Data Addressing Modes of TMS32OC54xx., TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

UNIT III VLIW ARCHITECTURE 9 hours

Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Optimizations, Heuristics. Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple application developments as an embedded environment.

UNIT IV FPGA BASED DSP SYSTEMS 9 hours

Limitations of P-DSPs, FPGA based signal processing design-case study of a complete design of DSP processor.

UNIT V HIGH PERFORMANCE COMPUTING USING P-DSP 9 hours

Modified bus structures and memory access in PDSPs, special addressing modes in PDSPs, Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

Course Outcomes:

After completing this Unit, students will be able to
1. Identify and formalize architectural level characterization of DSP hardware.
2. Design and test various digital signal processors.
3. Write assembly language programming for various digital signal processors.
4. Utilize FPGA based DSP hardware for Control, Audio and Video Signal processing applications.
5. Understand the High-Performance Computing using P-DSP.

Text Book(s)

1. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education Private Limited, 2011.
2. Phil Lapsley; Jeff Bier; Amit Shoham; Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features", Wiley-IEEE Press, 1997.

Reference Books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A practical approach", Pearson-Education, PHI, 2002.
2. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors: Architectures, Implementations, And Applications", Pearson/Prentice Hall, 2005.
3. Peter Pirsch, "Architectures for Digital Signal Processing", John Wiley & Sons, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - V

Professional Elective – V

20ECE416 DIGITAL IMAGE AND VIDEO PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite **20ECE110**

Course Description:

This course provides the fundamental knowledge on processing images and videos and their applicationareas. In this course, different image processing operations such as enhancement, filtering, coding andsegmentation are presented. In addition, it includes different video processing operations such as videocoding and segmentation.

Course Objectives:

1. To provide the basic understanding of the digital image formation and visualization.
2. To provide the visualization of relationships between spatial and frequency.
3. To provide the understanding of mapping the signal processing techniques to the digital image.
4. To provide an idea of multimedia data (image, video).
5. To provide an exposure to various image and video compression standards

UNIT I Digital image and Video fundamentals 9 hours

Image Processing Fundamentals -- Digital image formation, image sampling and quantization, resolutions and representation, basic relationship between pixels, types of digital images. color image processing: color representation, chromaticity diagram and color spaces, digital imaging and application areas, Enhancement- Point Processing: Contrast Stretching, Power-law and Gamma Transformation.

Video Processing Fundamentals – Digital Video Signal, Digital Video Standards, Needs of Digital Video, Time Varying Image Formation Models –Geometric Image Formation, Photometric Image Formation, Spatio-Temporal Sampling - Two-Dimensional Rectangular Sampling, Sampling on 3D structure

UNIT II Image enhancement, filtering and color image processing 9 hours

Image Enhancements and Filtering

Gray level transformations, histogram equalization and matching, Degradation function and Noise Models, smoothing filters – sharpening filters – two-dimensional DFT and its inverse - frequency domain filters – low pass and high pass.

Color Image Processing

Color models–RGB, YUV, HIS - color complements, color slicing, tone and color corrections – Color image smoothing and sharpening - Color Segmentation.

UNIT III Image coding and Segmentation 9 hours

Image Coding –

Fundamentals of image compression, image data redundancies, Image Compression Model, Huffman Coding, Arithmetic Coding, Run Length Coding, Bit Plane Coding, Block Transform Coding, JPEG compression standard – DCT based image compression

Image Segmentation -

Detection of discontinuities, edge linking and boundary detection – global and adaptive thresholding, region-based segmentation.

UNIT IV Video Coding 9 hours

Inter-Frame Redundancy, Motion Estimation Techniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – Group of pictures, frames, slices, macro-blocksand blocks - Elements of a video encoder and decoder - Video coding standards – MPEG and H.26X.

UNIT V Video Segmentation 9 hours

Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts- spatial segmentation – Videoobject detection and tracking.

Course Outcomes:

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

1. Application of mathematics to represent the connectivity and neighborhood relationship between pixels and frames.
2. Understand application-based image enhancement and filtering.
3. Develop algorithms for image segmentation and coding in image processing.
4. Analyze different video coding techniques and their areas of application.
5. Apply video segmentation, object detection and tracking in videos.

Text Book(s)

1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson, 4th edition, 2018.

2. Anil Kumar Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2nd edition, 2004.

Reference Books

1. Willam K. Pratt, "Digital Image Processing", 3rd edition by John Willey & Sons, 2001

2. Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd edition, 2015.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – V

20ECE417 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course introduces the concept of Wireless Sensor Network (WSN) to the students. It articulates the classification of WSN and related issues & challenges. It also describes different types of routing, MAC, dissemination protocols and explains design principles of wireless sensor networks.

Course Objectives:
This course enables students to
1. Understand the concept of WSN, issues and challenges, classification of WSN.
2. Acquire knowledge on the hardware components, design constraints and Operating systems used in WSNs.
3. Acquire the knowledge involved in the classification of routing and MAC protocols.
4. Understand the skills required for data base management in large sensor network.
5. Explain the design principles related to gateway of WSNs.

UNIT I: BASICS OF WSN **9 hours**
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

UNIT II: DESIGN CONSIDERATION FOR WSN **9 hours**
Single-node architecture, Hardware components& design constraints. Operating systems and execution environments, introduction to TinyOS and nesC.

UNIT III : WIRELESS PROTOCOLS **9 hours**
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

UNIT IV: DATA PROCESSING **9 hours**
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT V: GATEWAY OF WSN **9 hours**
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Course Outcomes:
At the end of the course the students will be able to
1. Describe the phases, identify, list and compare Wireless Sensor Network.
2. Discuss and identify the choice of OS with architectural framework.
3. Understand the characteristics and selection of suitable MAC protocol for wireless sensor network.
4. Understand and describe the database management mapping onto the network topology of wireless sensor network.
5. Design the gateway on application-level information for WSN.

Text Books

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley & Sons Publications, 2011.

2. Soloman, Sabrie," Sensors Handbook" Second Edition McGraw-Hill Education, 2010.

Reference Books

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,1st edition 2004.

2. Sohraby, Kazem, Daniel Minoli, and Taieb Znati. Wireless sensor networks: technology, protocols, and applications. John wiley & sons, 2007.

3. Levis, Philip, and David Gay. TinyOS programming. Cambridge University Press, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – V

20ECE418 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE109, 20ECE113**

Course Description:

This course gives an introduction to Satellite Communication Systems which describe topics like spacecraft link analysis and link design. The various satellite access techniques like FDMA, TDMA and CDMA will be analysed from bandwidth utilization and throughput capability. The typical phenomena in satellite communication. VSAT, Mobile satellite communication and Personal Satellite communication will be discussed. The principles of Global Positioning System (GPS) principles, GPS receivers and its applications would be covered. The satellite link budget will also be estimated.

Course Objectives:

This course enables students to

1. Expose the students about the fundamental concepts of Satellite communication.
2. Enable the students to understand various sub-systems of satellite communication systems.
3. Analyze the various multiple access techniques and estimate satellite link budget.
4. Know the importance of commercial satellite systems &salient features VSAT Systems.
5. Elucidate the typical phenomena and GPS in satellite communication.

UNIT I INTRODUCTION AND OVERVIEW OF SATELLITE 9 hours

Historical background, Wireless communication and benefit, Brief history of Satellite systems, advantage, disadvantages, applications and bands used for satellite communication, IRNSS-NAVIC: Navigation with Indian Constellation.

Orbits: Two body problem, orbital mechanics, Kepler's laws, Orbital equations, orbit determination, orbital & spacecraft problems geostationary orbit, change in longitude, orbital perturbations, orbital effects in communication systems performance, concepts of Solar day and Sidereal day.

UNIT II SATELLITE SUB-SYSTEMS 9 hours

Satellite Subsystems: Telemetry, Tracking, command and monitoring, power systems, communication subsystems, Attitude and orbit control system (AOCS), Communication sub-system, power sub-system etc. Design of down links, uplink design, design of satellite links for specified C/N, system design example, inter modulation, calculation of C/N with inter modulation, Radio wave propagation effects & Impact on Satellite Links: Quantifying attenuation and depolarization, Atmospheric absorption, Cloud attenuation, Rain and ice effects, Doppler frequency shift phenomena and expression for Doppler shift.

UNIT III MULTIPLE ACCESS TECHNIQUES AND SATELLITE LINK BUDGET 9 hours

Multiple access techniques: FDMA, TDMA, CDMA techniques, comparison of multiple access techniques, error connecting codes.

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT IV COMMERCIAL SATELLITE SYSTEMS AND VSAT SYSTEMS 9 hours

Importance of commercial satellite systems Services, salient features VSAT Systems: Overview, Network Architecture, access control protocols, basic techniques, VSAT earth station engineering, calculation of Link margins for VSAT star network, System design procedure example, new developments.

UNIT V TYPICAL PHENOMENA IN SATELLITE COMMUNICATION AND GPS 9 hours

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies.
Global Positioning System (GPS): Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, differential GPS.

Course Outcomes:

At the end of the course students will be able to:
1. Acquire the knowledge of concepts and operation of satellite communication systems.
2. Describe the various subsystems of satellite, link design, rain fading and link availability, doppler frequency shift and perform interference calculations.
3. Compute parameters of orbital motions and understand multiple access techniques.
4. Understand the importance of commercial satellite systems and features VSAT Systems.
5. Analyze the typical phenomena and the performance of satellite communication systems.

Text Books

1. T. Pratt, C. W. Bostian and J. E. Allnutt, "Satellite Communications", Wiley India, 2nd edition, 2006.
2. Dennis Roddy, "Satellite Communications", Tata McGraw-Hill, 4th edition, 2008.

Reference Books

1. G. Maral and M. Bousquet, "Satellite Communications Systems: Systems, Techniques and Technology", John Wiley & Sons, 5th edition, 2009.
2. Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, "Satellite communications Engineering", Pearson Publications, 2nd edition, 2003.
3. Varsha Agrawal, and Anil K. Maini, "Satellite Communications" Wiley India, edition 2010.
4. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2nd edition, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - V

20ECE419 ERROR CORRECTING CODES

L	T	P	C
3	0	0	3

Pre-requisite 20ECE102

Course Description

This course is. mainly describes about Binary block codes for binary symmetric channel using Maximum Likelihood Decoding algorithm and Shannon Theorem for existing codes and calculating minimum distance for linear block codes and understanding the turbo coding. GDL perspective on Viterbi and BCJR decoding algorithm and we finally analyze BCH and RS codes using Finite field transform.

Course Objectives

This course enables students to

1. Compare the block code for Binary Symmetric channel and Maximum likelihood decoding algorithm and Shannon Theorem for good codes and Macwillians Krawtchouk Polynomials
2. Summarize the Linear Block codes using decoding tables, Hamming weight and distance and error corrections Vs Error Detection. Relate the decoding of Binary codes and Bounding using Maximum livelihood decoding algorithm generator matrix, parity check matrix and error correcting capability of a linear code.
3. Analyse the concept of algebraic geometric and Quasi cyclic codes with different algorithms.
4. Develop the Viterbi decoding algorithm using GDL, GDL perspective on Viterbi and BCJR decoding algorithm and turbo coding.
5. Illustrate and decode the BCH and RS code using finite field transform and combining the construction of codes.

UNIT I BASICS OF BINARY BLOCK CODES FOR THE BINARY SYMMETRIC CHANNEL 9 Hours

Mathematical preliminaries: groups, subgroups and cosets, Types of Errors, Error Control Strategies. Burst error correcting codes and error trapping, Shannon's theorem on the existence of good codes, Product codes, coding gain, Weight distribution of the dual of a binary linear code, group characters & codes, the theorems of McWilliams, Krawtchouk polynomials

UNIT II LINEAR BLOCK CODES 9 Hours

Definitions, minimum distance, Bounds on the size of a block code, Distance Isomorphic Codes, Hamming bound, Hamming Solution, perfect code, Singleton bound, Gilbert-Varshamov bound, Plotkin bound. Using bounds to determine and design good codes for a given set of parameters. Power of Linearity, generator Matrix, Cosets & Slepian array, methods of decoding of binary codes.

UNIT III ALGEBRAIC GEOMETRY (AG) AND QUASI CYCLIC CODES. 9 Hours

Algebraic AG Codes: Introduction, Bounds relevant to AG codes. Theorems and Concepts of curves and Planes, Generalized AG codes.

Algebraic Quasi Cyclic Codes: Introduction, Double circulant codes, Types of Double circulant codes and code construction, weight distribution of Double circulant codes.

UNIT IV BASICS OF CONVOLUTIONAL CODES 9 Hours

Definition, the tree and trellis code, Linear convolution, the generalized distributive law (GDL). The GDL perspective on the Viterbi and BCJR decoding algorithms. Sequential decoding, applications of convolution codes. Concatenated convolution codes.

UNIT V LDPC CODES FIELDS 9 Hours

Polynomials rings; construction of finite fields. Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes. Deducing the structure of a finite field; Subfields and cyclostome cosets. Turbo coding methods-symmetric , non-symmetric, interleavers etc. The finite field (Fourier) transforms; cyclic codes via finite field transforms. BCH and Reed-Solomon codes; decoding of BCH and RS codes, Reed-Muller codes, Quadratic-residue codes. Quasi-cyclic LDPC codes and protographs, Binary codes from MDS codes.

Course Outcomes

After completing this Unit, students will be able to

1. Summarize the Block codes and Maximum Likelihood Decoding algorithm, weight distribution dual of a binary code.
2. Compare the Decoding Tables, Hamming Weight, Distance and Error Correction vs detection, Correcting Capability of a Linear code
3. Classify the algebraic coding methods using different techniques.
4. Correlate the BCH and RS codes using finite field Fourier transform.
5. Analyze of error detecting and correcting system to meet the given system specification using GDL perspective on Viterbi, turbo codes, and BCJR Decoding algorithm.

Text Book(s)

1. Todd K. Moon., "Error Correcting Coding: Mathematical Methods and Algorithms", Wiley Publishers, 2005.
2. John Baylis., "Error Correcting Codes-A Mathematical Introduction", CRC press, 2008.

Reference Books

1. Martin Tomlinson, Cen Jung Tjhai, Marcel A. Ambroze, Mohammed Ahmed, Mubarak Jibril, "Error-Correction coding and Decoding-Bounds, Codes, Decoders, Analysis and Applications", Springer publishers, 2nd Edition, 2015.
2. Scott A.Vanstone and Paul C,Van Oorschot, "An Introduction To Error Correcting Codes with Applications", Springer Science Publishers, 2nd Edition, 2016.
3. W.Cary Huffman and Vera Pless, "Fundamentals of Error Correcting Codes", Cambridge Press, 1st Edition, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – V

20ECE420 RFICs

L	T	P	C
3	0	0	3

Pre-requisite 20ECE106

Course Description:

This course illustrates the Integrated circuit (IC) implementation of RF circuits for wireless communications applications. The course comprises a detailed description of high-frequency amplifier design for current wireless communications standards and active/passive device technologies for RFIC implementations. The fundamentals of low-noise amplifiers, mixers, frequency sources, Oscillators, and Synthesizers are also included.

Course Objectives:

This course enables students to

1. Understand the characteristics of passive IC components at RF frequencies.
2. Expose design aspects of high-frequency amplifiers and low-noise amplifiers.
3. Distinguish between different types of mixers.
4. Understand the concepts of different types of oscillators.
5. Understand about synthesizers at RF frequencies.

UNIT I INTRODUCTION 9 hours

Characteristics of passive IC components at RF frequencies – interconnects, resistors, capacitors, inductors, and transformers – Transmission lines Classical two-port noise theory, noise models for active and passive components, Noise figure, Nonlinearity, cascaded stages, Sensitivity, and dynamic range

UNIT II HIGH-FREQUENCY AMPLIFIER DESIGN 9 hours

Zeros as bandwidth enhancers, shunt-series amplifier, fT doublers, Low noise amplifier design – LNA topologies, impedance matching, power-constrained noise optimization, linearity, and large signal performance

UNIT III MIXERS 9 hours

Fundamentals of mixers, multiplier-based mixers, sub sampling mixers, diode-ring mixers.

UNIT IV OSCILLATORS 9 hours

Feedback View of Oscillators, Colpitts oscillator, Hartley oscillator, describing functions, tuned oscillators, negative resistance oscillators.

UNIT V SYNTHESIZERS 9 hours

Basic Integer-N Synthesizer, synthesis with static moduli, combination synthesizers, phases noise considerations.

Course Outcomes:

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

1. Understand passive components at RF frequencies and required circuit theory
2. Design high-frequency amplifiers and low-noise amplifiers
3. Compare different types of mixers
4. Describe different types of oscillators at RF frequencies
5. Analyze synthesizers at RF frequencies

Text Book(s)

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", UK: Cambridge University Press, 2nd edition, 2012.
2. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 3rd Ed., 2011.

Reference Books

1. Behzad Razavi, "RF Microelectronics", 2nd Ed., Prentice Hall, 2012.
2. Ludwig, "Rf Circuit Design", 2nd Ed., Pearson, 2009.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – V

20ECE421 COMMUNITY RADIO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite 20ECE109

Course Description:

This course offers a comprehensive exploration of Community Radio, from foundational concepts to practical implementation. It begins with an introduction to the principles of Community Radio and guides students through the process of establishing a Community Radio Station (CRS). Key topics include Studio Technology, Operations and Management along with detailed instruction in Audio Pre-Production and Post-production techniques. Students will also gain essential knowledge of Radio Transmission technology, including the setup of an FM transmitter. By the end of the course, students will have a thorough understanding of Community Radio principles and the Practical skills required to effectively operate a Community Radio station.

Course Objectives:

This course enables students to

1. Associate the concept of fundamentals in Community Radio in Local Communication and development.
2. Gain knowledge of Studio technology and operations including Soundboards, Microphones, Recording, scheduling, content creation, and team coordination.
3. Develop skills in Audio Pre-production and post-production such as recording, editing, and mixing audio content.
4. Categorize the Radio Transmission Technology comprising signal requirements aligning with factors affecting Coverage and Shadow Areas.
5. Explore Radio Transmission technology essentials and understand the technical aspects of setting up and maintaining an FM transmitter.

UNIT I COMMUNITY RADIO FUNDAMENTALS AND SETUP 9 hours

Introduction to Radio Broadcasting in India - Community Radio: Evolution - Community Radio Policy – Technical principles; Components of a CR Station - Radio Waves and Spectrum - Basics of Electricity - Power Backup and Voltage Stabilization

UNIT II STUDIO TECHNOLOGY & OPERATIONAL PRACTICES 9 hours

Basics of Sound - Analog and Digital Audio - Components of the Audio Chain - Studio Acoustics; Good Engineering Practices for Studio Setup - Studio Equipment: Preventive & Corrective Maintenance - Content Distribution: Alternative Mechanisms

UNIT III AUDIO PRE & POST PRODUCTION 9 hours

Audio Hardware and Field Recording – Microphones - Audio Cables and Connectors - Free and Open-Source Software - Telephony for Radio - Landline Systems - GSM/CDMA - Voice Over Internet Protocol (VoIP); Sound Recording and Editing - Mixing and Mastering - File Formats and Compression Transmission - Storing and Retrieval

UNIT IV RADIO TRANSMISSION TECHNOLOGY 9 hours

Transmission Chain Overview – Live and Pre-recorded Transmission - Principles of FM Transmission – FM Transmitter console- Antenna System - Types of Mast/Towers - Layers of Atmosphere and Radio Wave Propagation - Factors Affecting Coverage and Shadow Areas - Signal Requirements and Coverage Planning Parameters

UNIT V FM TRANSMITTER SETUP 9 hours

Connecting Audio Feed to the Transmitter - Back Panel Connectors - Mounting and Connecting the Transmitter - Probable Causes of Failure of Transmitters - Fault Diagnostics and Corrective Maintenance - Transmitter Operation and Upkeep Issues

Course Outcomes:

Upon the completion of the course, Student will be able to

1. Interpret the evolution with a framework of Community Radio with Technical Principles and essential Radio Spectrums.
2. Apply Studio Technology and Operational practices with the components of the Audio Chain including Acoustics and Equipment maintenance.
3. Conduct Comprehensive Audio Pre & Post-production to operate field Recordings with Hardware and Open-source software to manage sound recording, editing, mixing, mastering, and file compression.
4. Infer the principles of FM transmission, Antenna systems, Radio wave propagation and factors affecting coverage.
5. Demonstrate knowledge of the connecting audio feeds for Transmitter setup by resolving operational Issues with corrective maintenance.

Text Book(s)

1. Pooja Murada R. Sreedher, "Community Radio in India", Aakar Books, 2019.
2. Prof. Raj Misra , "Community Radio By the people, For the People", Orange Books Publication, 2022

   Fraser, Colin, and Sonia Restrepo Estrada, "Community radio handbook". Paris: Unesco, 2001.

Reference Books

1. Juliet Fox, "Community Radio's Amplification of Communication for Social Change", 7th Edition, Palgrave Macmillan (Springer International Publishing.), 2019.
2. Kanchan K. Malik, Vinod Pavarala, "Community Radio in South Asia: Reclaiming the Airwaves", Routledge India, 2020.
3. Vinod Pavarala and Kanchan K. Malik, "Other voices: the struggle for community radio in India",Sage Publications India Pvt Ltd, 2007.
4. Michael C. Keith, "The Radio Station: Broadcast, Satellite & Internet", 7th Edition, Focal Press (Elsevier Inc.), 2007.
5. "Certificate in Community Radio Technology (CCRT)" https://www.cemca.org/resources/certificate-community-radio-technology-ccrt-0

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Courses

Skill Oriented Course – I

20ENG601 CORPORATE COMMUNICATION

L	T	P	C
1	0	2	2

Pre-requisite: **20ENG201**

Course Description:

English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives:

This course enables the students to –

1. Focus on their interactive skills
2. Develop their communicative competency
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I LISTENING SKILLS **8 hours**

Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING **10 hours**

Articulation of sounds; Intonation.; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations**:** Role play.

UNIT III READING SKILLS **8 hours**

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS **9 hours**

Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion.
Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.

UNIT V INTERVIEW SKILLS **10 hours**

Different types of interviews: Answering questions and offering information; Mock interviews; Body Language.

Course Outcomes:

At the end of the course, learners will be able to—

1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Text Books:

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference:

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let’s Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10 www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – II

20ECE601 PYTHON FOR DATA SCIENCE

L	T	P	C
1	0	2	2

Pre-requisite **20CSE101**

Course Description:
This course is designed to equipping students to be able to use python programming for solving data science problems.

Course Objectives:
This course enables students to
1. Train the students in solving computational problems
2. Elucidate solving mathematical problems using Python programming language
3. Understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

UNIT I INTRODUCTION TO NUMPY 6 hours

Introduction to Data Science and its importance - Data Science and Big data-, Establishing computational environments for data scientists using Python with IPython and Jupyter. NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions-Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.

- Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions
- Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting
- Computation on NumPy arrays using Universal Functions and Mathematical methods

UNIT II DATA MANIPULATION WITH PYTHON 6 hours

Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format

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- Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
- Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

UNIT III PANDAS DATA STRUCTURES WITH PYTHON 6 hours

Introduction to pandas Data Structures: Series, Data Frame,

- Create Pandas Series and Data Frame from various inputs.
-

UNIT IV DATA VISUALIZATION WITH PYTHON 6 hours

Function Application and Mapping- Sorting and Ranking, Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots

- Import any CSV file to Pandas Data Frame and perform the following:

(a) Visualize the first and last 10 records
(b) Get the shape, index and column details.

(c) Select/Delete the records(rows)/columns based on conditions.
(d) Perform ranking and sorting operations.
(e) Do required statistical operations on the given columns.
(f) Find the count and uniqueness of the given categorical values.
(g) Rename single/multiple columns.

- Import any CSV file to Pandas Data Frame and perform the following:

(a) Handle missing data by detecting and dropping/ filling missing values.
(b) Transform data using apply () and map () method.
(c) Detect and filter outliers.
(d) Perform Vectorized String operations on Pandas Series.
(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

UNIT V MACHINE LEARNING USING PYTHON 6 hours

Introduction Machine Learning: Categories of Machine Learning algorithms, Feature Engineering-Naive Bayes Classification - Linear Regression – k-Means Clustering.

- Write a program to demonstrate Linear Regression analysis with residual plots on a given data set.
- Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
- Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Python ML library classes.
- Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Course Outcomes:

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

1. Illustrate the use of various data structures.
2. Analyze and manipulate Data using Numpy and Pandas.
3. Creating static, animated, and interactive visualizations using Matplotlib.
4. Understand the implementation procedures for the machine learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Books:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.

2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

Reference Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.

2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.

3. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at https://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf

4. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016 4. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – II

20ECE602 SENSORS AND INSTRUMENTATION

L	T	P	C
1	0	2	2

Pre-requisite: 18EEE101

Course Description:

This course covers the basic Characteristics of various Sensors and Transducers. It gives a brief idea about principle and working of various Resistive Inductive and Capacitive Transducers. The measurement of non-electrical quantities is also dealt with applications and miscellaneous transducers used in industries are also covered.

Course Objectives:

This course enables the students to –

1. Understand the principle and operation of various Bridges
2. Know the characteristics of Resistive Transducers
3. Understand various inductive and capacitive transducers
4. Study various types of signal conditioning circuits and A/D Converters.
5. Study the Characteristics of miscellaneous transducers

UNIT I AC BRIDGES 6 hours

Introduction to Bridges -Wheat Stone Bridge, Kelvin Bridge, Schering Bridge, Anderson's Bridge and Maxwell Bridge.

- Measurement of Low Resistance by Kelvin's Bridge.
- Measurement of Self Inductance using Anderson's Bridge.
- Measurement of Capacitance using Schering Bridge

UNIT II RESISTIVE TRANSDUCERS 6 hours

Strain gauge –Types– Applications – RTD - Temperature Sensors -Thermistors – Thermocouple- Constructions, Load Cell- Characteristics

- Calibration of Strain gauge for strain measurement
- Calibration of Resistance temperature detector
- Calibration of thermistor for temperature measurement
- Calibration of thermocouple for temperature
- Load Cell Characteristics

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCER 6 hours

Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer - Piezoelectric transducer -Rotary displacement transducers -Capacitive transducer – Types, Microphone-Speakers.

- Study and calibration of LVDT for displacement measurement
- Calibration of Capacitive transducer for displacement measurement
- Measurement of sound using microphones
- Calibration of microphone
- Calibration of rotameter

UNIT IV SIGNAL CONDITIONING 6 hours

Comparators- Instrumentation amplifier -Active Filters-Sample and hold circuit-A/ D Converters-Successive approximation-ADC, Flash type ADC

- Design and testing of Digital Comparator
- Design and testing of sample and hold circuit.
- Design and testing of Active filters
- Design and testing of Voltage to frequency converter and frequency to voltage converter.
- Design and testing of Flash type Analog to Digital Converters.

UNIT V MISCELLANEOUS TRANSDUCERS 6 hours

Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Gyroscope

- Design of Piezoelectric transducers using MEMS open source software (MEMS pro, SUGAR)
    - i. Pressure sensors
    - ii. Accelerometers
    - iii. Gyroscopes

Course Outcomes:

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

1. Apply the concepts for bridges converting a physical parameter into an electrical quantity
2. Understand the functions and characteristics different resistive transducers
3. Demonstrate the working of inductive and capacitive transducers
4. Identify various signal conditioning devices and its characteristics
5. Design Piezoelectric transducers using MEMS

Text Books:

1. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and Instrumentation”, 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Patranabis. D, “Sensors and Transducers”, Prentice Hall of India, 2003.

References:

1. Doebelin. E.A, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2000. 3. John. P, Bentley, “Principles of Measurement Systems”, III Edition, Pearson Education, 2000.
2. Murthy. D. V. S, “Transducers and Instrumentation”, Prentice Hall of India, 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – II

20ECE603 MATLAB FOR ENGINEERS

L	T	P	C
1	0	2	2

Pre-requisite **20MAT101, 20EEE101**

Course Description:

This course introduces students to MATLAB programming, and demonstrate its use for scientific computations. The basis of computational techniques is expounded through various coding examples and problems. The practical ways to use MATLAB will be discussed.

Course Objectives:

This course enables students to

1. Understand basic MATLAB commands and elementary functions
2. Study and implement mathematical operations and matrices manipulation
3. Understand MATLAB functions and expressions
4. Apply flow control and files in MATLAB
5. Understand Plotting and Simulink blocks in MATLAB

UNIT I MATLAB BASICS 6 hours

Introduction, Matlab environment, Matlab as a calculator, Matlab Online, Syntax and Semantics, Help, Data Types-Matrix, string, cell and structure, Variables and Arrays, **Initializing Variables,** Multidimensional Arrays, Sub arrays, Special Values, Displaying Output Data, Data Files, Scalar and Array Operations, Hierarchy of Operations, Built-in MATLAB Functions, Debugging MATLAB Programs

- Swap the values in two variables without using temporary variable. For example, the variable ‘x’ contains the value ‘5’ and the variable ‘y’ contains the value ‘10’. The program should swap the values in the variable’s ‘x’ and ‘y’. After the execution of the program the value in the variable ‘x’ should be ‘10’ and the value in the variable ‘y’ should be ‘5’. This should be accomplished without using the temporary variable.
- Write a function which should return either maximum or minimum value of the element in an array.
- Write a code to find whether the given number is even or not.
- Write a function that should sort the elements in the array either in the ascending order or descending order.
- Write a program which should count the number of occurrences of particular element in the array.

UNIT II MATRICES AND OPERATORS 6 hours

Introduction, Colon Operator, Accessing Parts of a Matrix, Combining and Transforming Matrices, Arithmetic operations

- Write a program to find the maximum and minimum value of the elements of the matrix
- Write a program to compute the sum of diagonal elements of the given matrix
- Write a program to test whether the given matrix is symmetric or not?

- Obtain the rank of the following matrices (i) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ (ii) $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix}$ and comment on the result.
- Write a program to check whether the given matrix is invertible or not? {Hint: A matrix is invertible if is not singular. The determinant of the matrix should not be equal to zero}
- Write a program to check the given matrix is orthogonal or not?
- Use the built-in function to compute the eigen value and the eigen vector of the given matrix. From the eigen value is it possible to find whether the given matrix is (i) Positive definite (ii) Positive semidefinite.

- Create a vector 'x' that should contain elements from 1 to 10. Write a code to perform the following operation
  - (i) Add a constant (say 3) to each element of 'x'.
  - (ii) Make all the even indexed elements to zero.
  - (iii) Make all the odd indexed elements to zero.
  - (iv) Generate 'y' which should contain elements in the reverse order of 'x'.
  - (v) Generate 'y' such that it should have first five elements of 'x' and the remaining elements to zero
  - (vi) Add the constant to odd indexed elements of 'x'.
  - (vii) Add the constant to the even indexed elements of 'x'
- Write a program to solve the linear algebraic equation
  - (i) 5x-3y+2z = 10
  - (ii) -3x+8y+4z = 20
  - (iii) 2x+4y-9z = 9
- Write a program to determine the eigen vector and eigen values of A = [1 2 3; 4 5 6; 7 8 9]

UNIT III FUNCTIONS AND EXPRESSIONS 6 hours

Introduction, Function I/O, Formal Definition of Functions, Sub functions, Scope, Advantages of Functions, Scripts, and Problem-Solving **File Input-Output, Expressions,** write a function which returns the "median" of the array of elements.

- Write a code to print the prime numbers from one to hundred.
- Write a function which accepts the radius of the circle as input and returns the area and perimeter of the circle.
- Write a code which will compute sum of integers ranging from 1 to 100.
- Write a code to compute the "body mass index". The input to the code should be (i) Weight and (ii) Height of the person. The output of the program should be "body mass index (bmi)"
- Write a program to convert the temperature in degrees to Celsius.
- Write a program to check whether the given string (word) is palindrome or not?
- Write a program to compute the factorial of the given number.
- Find the roots of the polynomial

$$f(x) = 3x^6 + 15x^5 + 10x^3 + 4x$$

- An R-L-C circuit has R = 180 ohms, C = 1/280 farads, L = 20 Henries and an applied voltage E(t) = 10 sin t. Assuming that no charge is present but an initial current of I ampere is flowing at t = 0 when the voltage is first applied, find q and $i = \frac{dq}{dt}$ at any time t. q is given by the differential equation.

  $$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E(t)$$

- The function sin(x) can be written as a Taylor series by:

  $\sin x = \sum_{k=0}^{\alpha} \frac{(-1)^k x^{2k+1}}{(2k+1)!}$ Write a user-defined function file that calculates sin(x) by using the Taylor series.

UNIT IV FLOW CONTROL AND FILES 6 hours

For – Loops, While – Loops, Break Statements, Logical Indexing, Pre allocation. Data Types: Introduction, Strings, Structs, Cells. Selection, If – Statements, Relational and Logical Operators, Nested If – Statements, Variables Number of Function, Arguments, Robustness, Persistent Variables. switch and case statement, while statement, break, Continue. **Files- File Input/ Output: File I/O, Excel Files, Text Files, Binary Files.**

- Without using the **max** command, find the maximum value of matrix (a) where a =[11 3 14;8 6 2;10 13 1]

- Let x=[2 6; 1 8], y=[.8 -0.3 ; -0.1 0.2], prove that y is not the inverse matrix of x
- The value of s could be calculated from the equation below:

$$s = \begin{cases} \sqrt{y^2 - 4xz} & if \ \ y \geq 4xz \\ \alpha & if \ \ y > 4xz \end{cases}$$

write a MATLAB program in M-File to do the following steps: -

a) input the value of x, y, z

b) calculate s

c) print the output as shown below

x = . . .
y = . . .
z = . . .
s = . . .

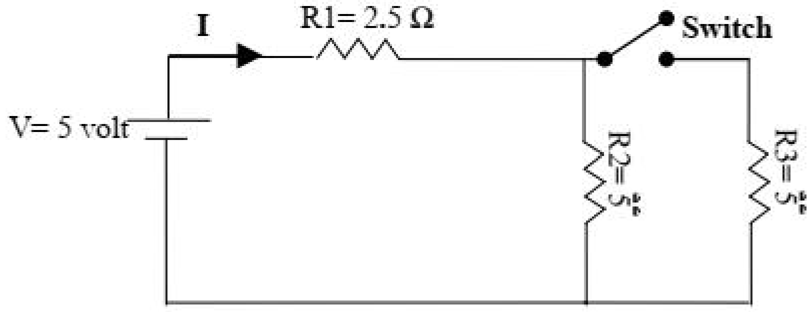
- Use a for-end loop in a script file to calculate the sum of the first n terms of the series:

$\sum_{k=1}^{n} \frac{(-1)^k k}{2^k}$ Execute the script file for n = 4 and n = 20.

- Write a program to find the current I in the circuit shown below

a) By using conditional statements.

b) Without using any conditional statements.



UNIT V PLOTTING AND SIMULINK 6 hours

Two – Dimensional Plots - Plot, fplot, Multiple Graphs, Formatting, Logarithmic Axes, Error Bars, Special Graphics, Histograms, Polar Plots, Multiple Plots on The Same Page, Multiple Figure Windows, **Three-Dimensional Plots-** Line Plots, Mesh and Surface Plots, Special Graphics, View Command. **Simulink:** Getting Started, Simulink Library Browser, Basic Elements-Blocks, Lines, building a System-Gathering Blocks, Modifying the Blocks, Connecting the Blocks, Running Simulations, Specification, Toolboxes, Building Systems.

- The expression for sine wave is given by $x(t) = A\sin(2\pi ft + \phi)$ .Write a code which accepts the input as (i) Amplitude (A) (ii) Frequency (f) and (iii) Phase(ϕ) and generates the sine wave. Plot the sine wave.
- Write a program to convert the sine wave to (i) Half wave rectified sine wave and (ii) Full wave rectified sine wave.
- Write a program which converts the sine wave to a square wave [Equivalent to that of “zero-crossing detector” or “comparator” concept in “Linear Integrated Circuits”].
- Write a program to generate three-phase sinusoidal signal. [The student should know what is the phase difference between three phases in a three-phase sinusoidal signal and the importance of three phase power]
- Design a Simulink block for power electronic circuits

Course Outcomes:

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

1. Interpret the MATLAB commands and elementary functions
2. Solve mathematical operations and matrices manipulation
3. Apply MATLAB functions and expressions
4. Execute implementation of flow controls and files in MATLAB
5. Demonstrate Plotting and Simulink blocks in MATLAB.

Text Books:

1. Getting Started with MATLAB, Rudra Pratap Oxford University Press, 1st edition, 2019

2. MATLAB for Beginners: A Gentle Approach, Kattan, Peter Issa, Petra books, 2008

Reference Books:

1. MATLAB for Engineering Applications, William Palm, Mcgraw Hill,4th edition, 2019.
2. MATLAB for Engineers**,** Holly Moore, Pearson Education,5th edition,2018

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – III

20ECE604 PRINTED CIRCUIT BOARD (PCB) DESIGNING

L	T	P	C
1	0	2	2

Pre-requisite **20ECE203**

Course Description:
This course is intended to give students a basic understanding of PCB design. PCB design is an important aspect of every electronic product, and this course is meant to prepare students to design their own PCB projects to meet industrial standards.

Course Objectives:
This course enables students to

1. Study the fundamental steps involved in PCB design.
2. Understand the concept of designing single layer and multilayer PCB.
3. Study the different design considerations of PCB Fabrication.
4. Obtain knowledge of various EDA tools for PCB designing.
5. Study various standards in PCB testing.

UNIT I Introduction **6 hours**

PCB definition, Evolution of PCBs, PCB materials, PCB design tools, PCB development process, PCB soldering tools, soldering flux, soldering wires, and cleaning materials.

- Introduction to Printed circuit board: Fundamental of electronic components.
- Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, crosstalk, check and inspection of artwork

UNIT II Fundamentals of Printed Circuit Boards **6 hours**

Components of PCB, Basic Electronic Circuits, Classification of PCBs, Manufacturing of PCBs, Single sided, double sided, Multilayer, and Flexible Boards, Challenges in PCB design and Manufacturing, Standards on PCB.

- Study on types of PCB layers, through Hole and SMD Components.
- Schematic Creation and simulation of an electronic circuit
- Mapping Components of an electronic circuit
- Set Parameters for PCB Design.

UNIT III Layout Design Considerations **6 hours**

General PCB design Consideration, Mechanical Design Consideration, Electrical Design Consideration, Conductor Patterns, Component Placement Rules, Fabrication and Assembly Consideration, Environmental Factors, Cooling Requirements and Package Density.

- Create PCB Layout of a clamper circuit
- Create PCB Layout of a Full-wave Rectifier.
- Create PCB Layout of an ASTABLE MUTIVIBRATOR USING 555 IC

UNIT IV Electronic Design Automation Tools 6 hours

Introduction to Electronic design automation (EDA) tools for PCB designing: Brief Introduction of various simulators, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto-routing and manual routing. Assigning specific text (silkscreen) to design, creating design report, and creating manufacturing data (GERBER) for design.

- Create PCB Layout of Transistor Amplifier.
- Create PCB Layout of RC Phase Shift Oscillator Circuit
- Create PCB Layout of Summing Amplifier Using OPAMP
- Create PCB Layout of full adder using half-adders.

UNIT V Quality, Reliability, and Acceptability Aspect 6 hours

Quality assurance, Teasing for Quality Control, Quality Control Methods, Testing of Printed Circuit Boards, Reliability Testing, Acceptability of PCBs, and Useful Standards.

- Create PCB Layout of J-K flip flop.
- Create PCB Layout of 4-BIT Binary Counter
- Create PCB Layout of variable DC power supply.
- Create PCB Layout of Temperature Sensing Circuit

Course Outcomes:

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

1. Understand the fundamental process in PCB design.
2. Understand the design and manufacturing techniques of PCB.
3. Create and Fabricate PCB using EDA tools.
4. Comprehend the standards involved in PCB design.
5. Evaluate and test the PCB for the designed circuits.

Text Book(s)

1. Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002
2. Simon Monk, Make your own PCBs with Eagle: from schematic designs to finished boards, McGraw-Hill Education Pvt Ltd., 2014.

Reference Books

1. RS Khandpur, Printed Circuit Board, Tata McGraw Hill Education Pvt Ltd., New Delhi,2006
2. C. Coombs, Printed Circuits Handbook, McGraw-Hill Professional, 6 editions, 2007
3. Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008
4. S D Mehta, Electronic Product Design Volume-I, S Chand Publications, 2011
5. V. Shukla, Signal Integrity for PCB Designers, Reference Designer, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – III

20ECE605 ARTIFICIAL INTELLIGENCE FOUNDATIONS

L	T	P	C
1	0	2	2

Pre-requisite Nill

Course Description:
This laboratory course will drive the students into the fundamentals of AI, basic principles of data structure and data visualization. Also develop a practical understanding of Python as an AI tool.

Course Objectives:
This course enables students to
1. Train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 6 hours

Evolution and Definition of AI, Difference Between Narrow, General and Super AI, Applications of AI across industries, Opportunities in AI, Principles of Machine Learning.
1. Study of Numpy and Pandas basic programs.
2. Write a program to implement Breadth First Search using Python.

UNIT II DATABASE CONCEPTS 6 hours
Introduction to Database Concepts, Foundations of Databases, Implementations of Database Structures
1. Write a program to implement Depth First Search using Python
2. Write a program to implement Tic-Tac-Toe game using Python.

UNIT III AI PROGRAMMING FUNDAMENTALS: PYTHON 6 hours
Introduction to AI Programming with Python, Basic Python Programming for AI, Algorithms, Sorting Algorithms, Searching Algorithms, Geometric and Graphing Algorithms.
1. Write a program to implement 8-Puzzle problem using Python.
2. Write a program to implement Water-Jug problem using Python
3. Write a program to implement Travelling Salesman Problem using Python

UNIT IV AI STATISTICS: PYTHON 6 hours
Basic Statistic Concepts, Descriptive Statistics.
1. Write a program to implement Tower of Hanoi using Python.
2. Write a program to implement Monkey Banana Problem using Python.

UNIT V DATA VISUALIZATION WITH PYTHON 6 hours
Fundamentals of Data Visualizations, Types of Visualization Tools: Basic and Specialized, Graph Types.
1. Write a program to implement Missionaries-Cannibals Problems using Python.
2. Write a program to implement 8-Queens Problem using Python

Course Outcomes:

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

1. Formulate a problem and build intelligent agents
2. Apply appropriate searching techniques to solve a real world problem
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports

Text Book(s)

1. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.

2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

Reference Books

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.

2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.

3. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – III

20ECE606 OBJECT ORIENTED PROGRAMMING USING C++

L	T	P	C
1	0	2	2

Pre-requisite Nill

Course Description:
This lab course provides in-depth coverage of object-oriented programming principles and techniques using C++. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features.

Course Objectives:
This course enables students to
1. Provide basic characteristics of OOP through C++.
2. Introduce the concepts of class, method, constructor, instance, overriding, overloading
3. Impart skills on various kinds of overloading and inheritance.
4. Introduce the principles of virtual functions and polymorphism
5. Introduce pointers and file handling in C++ together with exception handling mechanism

UNIT I OVERVIEW OF C++ 6 hours

Getting started with C++ syntax, data-type, variables, expressions, operators, statements, arrays, strings, pointers and functions. Introduction to object-oriented programming, user defined types, structures, unions, polymorphism, and encapsulation.

1. Create a class named 'Student' with a string variable 'name' and an integer variable 'roll_no'. Assign the value of roll_no as '2' and that of name as "John" by creating an object of the class Student.
2. Write a class having two private variables and one member function which will return the area of the rectangle.
3. Perform addition operation on complex data using class and object. The program should ask for real and imaginary part of two complex numbers, and display the real and imaginary parts of their sum.
4. Write a program that ask for two numbers, compare them and show the maximum. Declare a function called max_two that compares the numbers and returns the maximum.

UNIT II CLASSES AND DATA ABSTRACTION 6 hours
Introduction, classes, Friend functions, Friend classes, Inline functions, Constructors, Arrays of objects, This pointers, Pointers to class members, Reference parameters, Dynamic allocation operators, Function overloading, Copy constructors, Operator overloading.

1. Using function overloading write C++program to find the volume of cube, cylinder, cone and sphere.
2. Write a C++ program illustrating an interactive program for swapping integer, real, and character type variables without using function overloading. Write the same program by using function overloading features and compare the same with its C counterpart.

3. Write a C++ program to perform different arithmetic operation such as addition, subtraction, division, modulus and multiplication using inline function.

UNIT III INHERITANCE, VIRTUAL FUNCTION & POLYMORPHISM 6 hours

Concept of inheritance. Derived class and based class. Derived class constructors, Member function, Class hierarchies, public and private inheritance, aggregation: Classes within classes, inheritance and program development, static and dynamic binding, Virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

1. Write a program to swap private data members of classes named class_1, class_2 using friend function.
2. Using operator overloading write a C++ program for class STRING and overload the operator + and == to concatenate two strings length.
3. Write a C++ program illustrating Constructor overloading (Both parameterized and default).

UNIT IV FILE STREAMS 6 hours

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Error handling during file operations.

1. Write a C++ program to read and print employee details using Files.
2. Write a C++ program to copy the contents of one text file to another file.
3. Write a C++ program that uses function template to determine the square of an integer, a float and a double
4. Write a Template Based Program to Sort the Given List of Element

UNIT V GENERIC PROGRAMMING AND EXCEPTIONS 6 hours

Function templates, Overloading template functions, Class templates, Exception handling techniques.

1. Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly.
2. Write a Program to Demonstrate the Catching of All Exceptions

Course Outcomes:

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

1. Understand the features of C++ supporting object-oriented programming
2. Apply the concepts of class, method, constructor, instance, overriding, overloading
3. Choose suitable inheritance while proposing solution for the given problem.
4. Apply virtual and pure virtual function & complex programming situations
5. Implement Object Oriented Programs using templates and file handling concepts.

Text Book(s)

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill

Reference Books

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education

2. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – IV

20ECE607 REAL TIME OPERATING SYSTEMS (RTOS)

L	T	P	C
1	0	2	2

Pre-requisite **20ECE107**

Course Description:
This laboratory course emphasizes to the students to understand the concepts of real time operating systems (RTOS). This course covers the different types of policies, multi-resource services and give embedded system components. It also covers the High availability and Reliability Design.

Course Objectives:
This course enables students to
1. Understand the introduction of real-time embedded systems
2. Know the different types of policies.
3. Understand the Multi-Resource Services techniques.
4. Learn the Embedded System Components.
5. Know the embedded system design based on availability and reliability.

UNIT I INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS 6 hours

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility. Uniprocessor Scheduling: Types of scheduling algorithms: FCFS, SJF, Priority, Round Robin UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept.

- Write the pseudo code in Linux using C/C++ to perform FCFS scheduling
- Write the pseudo code in Linux using C/C++ to perform Round Robin scheduling

UNIT II RTOS POLICIES AND PROCESS MANAGEMENT 6 hours
Pre-emptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies. I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency.
PROCESS MANAGEMENT: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals
- Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing.
- Write an application that Demonstrates the interruptible ISRs (Requires timer to have higher priority than external interrupt button

UNIT III MULTI-RESOURCE SERVICES& INTER-PROCESS COMMUNICATION 6 hours
Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, mixed hard and soft real-time services. Messages, Buffers, mailboxes, queues, semaphores
- Study of Semaphore & Write appropriate the pseudo code in Linux using C/C++
- Write an application to Test message queues and memory blocks

UNIT IV EXCEPTIONS, INTERRUPTS AND TIMERS 6 hours

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

- Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
- Write an application that creates a two task to Blinking two different LEDs at different timings.

UNIT V CASE STUDIES 6 hours

Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

- Developing image processing application with Linux OS on Xilinx FPGA
- Porting Linux and developing simple application on Xilinx Zed board

Course Outcomes:

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

1. Introduce real-time embedded systems
2. Describe the different types of policies.
3. Demonstrate the Multi-Resource Services techniques.
4. Explain the Embedded System Components.
5. Explain the embedded system design based on availability and reliability.

Text Book(s)

1. C.M. Krishna and G.Shin, Real Time Systems, McGraw-Hill International Edition, 2017.

2. Jean J Labrosse, Embedded Systems Building Blocks Complete and Ready-to-use Modules in C, CMP books, 2/e, 1999. (reprint 2011)

Reference Books

1. Jean J Labrosse, Micro C/OS-II, The Real Time Kernel, CMP Books, 2011.

2. Sam Siewert, V, Real-Time Embedded Components and Systems: With Linux and RTOS (Engineering), 2015.

3. Rajkamal, “Embedded Systems- Architecture, Programming, and Design”, 2007, TMH.

4. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

5. David E. Simon, An Embedded Software Primer, Volume1.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – IV

20ECE608 INTERNET OF THINGS

L	T	P	C
1	0	2	2

Pre-requisite **20ECE404**

Course Description:
This laboratory course is a network of a wide variety of thing such as moisture, temperature, motion detection and many more. The thing can be measured with the sensors and process through microcontroller devices. These devices also use the data processing units and gateways to process the data to control the other ends. This course is an introduction to the embedded devices, communication protocols and APIs used in IoT.

Course Objectives:
This course enables students to

1. Introduce the basic understanding IoT system
2. Expose the student to a variety of embedded system and interfaces
3. Create a basic understanding of the communication protocols in IoT communications.
4. Familiarize the student with networking and application program interfaces for IoT.
5. Enable students to create various use cases of IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS (IoT) 6 hours

Introduction, Concept and History: IOT History, IoT Applications, Requirements of IoT, Understanding IoT fundamentals, IOT Architecture and IOT challenges. Major functional components of IoT, IoT enabling technologies IoT, Standards IoT Entities, Overview of Sensors, Categorization of sensors and their working, Actuators, Gateways, Cloud and Web of technology.

Lab practices: -
1. Study on IoT Platform a) Getting information and study of IOT microcontrollers (Arduino, Raspberry-pi)
2. Study on IoT Platform a) Getting information about Sensors (IR, temperature, pressure, gas sensor) b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

UNIT II EMBEDDED SYSTEM (ARDUINO AND RASPBERRY PI) AND PERIPHERAL INTERFACES 6 hours

Embedded Computing Basics; Microcontrollers; System-on-Chips. ARM Architecture, Arduino Board development platform and Raspberry PI development platform.
IoT with Arduino General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces: I2C, SPI Sensors interfacing with Raspberry PI , IoT Real Time Operating Systems, General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces, I2C,SPI Sensors Interfacing with Raspberry Pi, Introduction of Arduino Python programming for IOT.

Lab practices: -
1.Programming with Arduino platform a) Installation of Arduino in computer and verifying any errors in connection. b) Control LED using Arduino c) Traffic Light Control
2.Programming with Arduino platform and Reading from Sensors a) interfacing sensors to Arduino board and getting information from them (any two sensors). b) Experiment with both analog and digital sensors.
3.Programming with Resperrypi a) Displaying Date on Serial Monitor b) Automated Door Opening System

UNIT III COMMUNICATION PROTOCOL FOR IOT 6 hours

Wireless Sensor Networks & Protocols, Machine to Machine Communication, Wired Communication Protocols. Ethernet Serial Communications, Wireless Communication protocols: Wifi, RF, IPV4/V6, 6LOWPAN, ZigBee (IEEE802.15.4) BLE, GSM(2G/3G/LTE),NFC, RF Comm and z wave and MAC Addresses, Application of MQTT/MQTT-SN, HTTP REST, XMPP and AMQP.

Lab practices

1.Connecting Android Phone with Arduino:

a) Connecting Arduino with Mobile Device Using the Bluetooth Module.

b) Control any two actuators connected to the development board using

2. Integrating Ethernet Shield. Read data from sensor and send it to a requesting client using socket communication. Note: The client and server should be connected to same local area network.

3. Creating Mobile App a) Create a mobile app to control an actuator. b) Control Electronic Devices from anywhere across the world using Internet & Mobile App.

UNIT IV NETWORKING FOR IOT 6 hours

Network Layer Model (OSI or TCP/IP), Network Topologies, Clouding computing, fog computing and big data technology, data handling and analytics, Introduction of Software define networking, Introduction of API and how to define new API.

Lab practices

1. Interfacing Cloud a) Push sensor data to cloud - Use Arduino to Upload data from Environmental Sensors to Cloud Server. b) Control an actuator through cloud
2. Data analysis and Visualization Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

social media with IoT Creating Program for Local host Web Server for controlling devices and update status on Twitter through Arduino.

UNIT V USE CASES OF IOT 6 hours

Case study of IOT applications

Introduction, models, technology used: Industrial internet of things, connected vehicles, Agriculture and IOT. Heath care and IOT, Smart grid system, Smart cities IoT Wearables, Health care systems and Allied sectors.

Lab practices

1. Mini Project Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it.

Course Outcomes:

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

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application with cloud and TCP/IP Model

Text Book(s)

1. Hanes, David, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry. IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press, 2017.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.

Reference Books

1. NPTEL Course on: Introduction of Internet of Things. By Prof. Sudip Misra | IIT Kharagpur
2. Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling technologies, platforms, and use cases. Auerbach Publications, 2017.
3. Richardson, Matt, and Shawn Wallace. Getting started with raspberry PI. " O'Reilly Media, Inc.", 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course - V

20ECE609 DIGITAL SIGNAL PROCESSOR

L	T	P	C
1	0	2	2

Pre-requisite **20ECE110**

Course Description:

This course is designed to help the students in implementing basic DSP algorithms using DSP processor. This laboratory starts with the introduction of DSP processor Kit and its architecture. Followed by generation of signals using DSP Kit. Various convolutions are also studied and implemented using DSP Kit. Subsequently, design of IIR and FIR filters is illustrated for low-pass and high-pass filtering. Finite Word Length Effect is studied for as an application of DSP for multi rate digital signal processing.

Course Objectives:

1. Understand various digital signal processor's architecture and tools.
2. Ability to apply knowledge of mathematics, science and engineering: Generation of signals using DSP Kit
3. Implement various convolutions using DSP Kit.
4. Understand the basic concepts of discrete signal representation such as Fourier transforms, discrete time representations. And design and implementations of IIR and FIR filtering algorithms and structures.
5. Understand the concept of Multi-rate signal processing and sample rate conversion.

UNIT I STUDY OF DSP PROCESSOR AND ITS ARCHITECTURE 6 hours

Architecture and DSP tools, features and instructions of fixed point and floating point processors. (TMS 320C25 and TMS320300), Applications of DSP, basics of speech and image processing.

- Introduction to the Digital Signal Processing Kit (DSK) and the Code Composer Studio (CCS)
- MAC operation using various addressing modes

UNIT II REVIEW OF SIGNALS AND SYSTEMS 6 hours

Review of signals and systems: Z-Transformation, properties, Inverse Z-transformation; Transform analysis of LTI System. Basic Signals

- Generation of signals and sequences using TMS320C6713DSK

UNIT III DISCRETE FOURIER TRANSFORM 6 hours

Properties of DFT: Linearity, Circular shift of a sequence, Symmetry properties, Circular convolution, Linear Convolution using DFT

- Linear Convolution using DSP Kit
- Circular Convolution using DSP Kit

UNIT IV IIR AND FIR FILTER DESIGN 6 hours

Design of IIR filters from analog filters, Design based on numerical solution of differential equations, bilinear transformations. Properties of FIR digital filters, Different types of windows: Rectangular, Barlett, Hanning, Hamming, Blackman and Kaiser windows, Design of FIR filters using above windows, A comparison of FIR and IIR filters.

- FFT Implementation using DSP Kit
- IIR & FIR Implementation using DSP Kit

UNIT V FINITE WORD LENGTH EFFECTS IN FIR AND IIR DIGITAL FILTERS: 6 hours

Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators.

- Study of Finite Word Length Effect using DSP Kit

Course Outcomes:

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

1. Understand various DSP processor's architecture and tools.
2. Generate various signals using DSP Kit.
3. Realize various convolutions using DSP Kit.
4. Analyse spectrum of DT signals using transform domain mathematical tools such as DFT, FFT. And also Design and Realize IIR filters and FIR filters for Filtering Application
5. Analyse Multirate Structures for Sampling Rate Conversion (Interpolation, Decimation, Fractional Rate Conversion)

Text Book(s)

1. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors – Architectures, Implementations and Applications", Pearson/Prentice Hall, 2005
2. Rulph Chassaing, Donald Reay, "Digital Signal Processing and Applications with TMS320C6713 and TMS320C6416 DSK", 2nd Edition, Wiley India, 2014.

Reference Books

1. S. K. Mitra, "Digital Signal Processing: A Computer based Approach", 4th Edition, McGraw Hill, 2013.
2. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education Asia/Prentice Hall of India, 2014.
3. Emmanuel Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", 2nd Edition, Pearson Education, 2002

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course - V

20ECE610 ANTENNA DESIGN

L	T	P	C
1	0	2	2

Pre-requisite :20ECE108,20ECE112, 20ECE603

Course Description:

To introduce the principles and theory of different types of antennas using in communication systems. Further, different mechanisms of wave propagation in free space will be discussed.

Course Objectives:

This course enables students to

1. understand radiation phenomena associated with various types of parameters
2. understand basic terminology and concepts of antennas along with emphasis on their applications.
3. Analyze the electric and magnetic field emission from various basic antennas with mathematical formulation of the analysis.
4. Explain radiation mechanism of different types of antennas and their usage in real time field.
5. Justify the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure

UNIT I ANTENNA BASICS 6 hours

Introduction to radiation concept – Antenna parameters – Directivity – Gain – Radiation pattern – Impedance – Polarization – Beamwidth – Antenna temperature – Antenna measurements and Requirement for measurements.

- Introduction to MATLAB antenna toolbox
- Design analysis using antenna designer app

UNIT II TYPES OF ANTENNAS 6 hours

Introduction to smart Antenna – Patch antenna – Microstrip patch

- Design of simple dipole antenna using MATLAB
- Design of simple patch using MATLAB
- Design of half folded dipole antenna using MATLAB
- Design of Yagi-Uda antenna using MATLAB

UNIT III ARAAY ANTENNAS 6 hours

Array of two sources – Pattern multiplication – Linear arrays – Broadside array – End fire array – Planar arrays.

- Design broadside array antenna using MATLAB
- Design of simple patch using MATLAB
- Design rectangular array of reflector backed rounded bowtie antennas

UNIT IV VHF, UHF and Microwave Antennas 6 hours

VHF, UHF and Microwave Antennas: Horn antennas- Types, Fermat‘s principle, optimum horns, design considerations of pyramidal horns

- Design of conformal array antenna using MATLAB
- Design infinite array using specified frequency and antenna
- Design horn antenna using MATLAB

UNIT V WAVE PROPAGATION 6 hours

Introduction, definitions, categorizations, general classifications, different Modes of Wave Propagation; Ground wave propagation: Introduction, plane earth reflections, space and surface waves, wave tilt, curved earth reflections; Space wave propagation

Course Outcomes:

After completing this Unit, students will be able to

1.Undesrstand about the radiation mechanism in wire antennas and Analyze the concept of antenna

2. Design smart antennas using Matlab
3. Undesrstand the various types of Array antennas and their applications.
4. Analyze the Microwave antennas with their applications, measure the different antenna parameters.
5. Analyze the structure of atmosphere for the wave propagation

Text Book(s)

1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, Antennas and Wave Propagation‖, TMH, 4th Edition, 2010.
2. K.D. Prasad, Satya Prakashan, Antennas and Wave Propagation‖, Tech India Publications, 1st Edition, 2001.

Reference Books:

1. C.A. Balanis, ―Antenna Theory, John Wiley and Sons, 2nd Edition, 2001
2. E.C. Jordan, K.G. Balmain, Electromagnetic Waves and Radiating Systems‖, PHI, 2nd Edition,2000.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor in Electronics & Communication Engineering
Stream Name: Communication Systems (CS)

Minor

20MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:
This course explores semiconductor physics, and operation & applications of semiconductor devices such as p-n junctions, BJTs, and MOSFETs. It also covers operational amplifiers and applications of operational amplifiers.

Course Objectives:
This course enables students to
1. Understand the operation of the basic semiconductor diodes, i.e., the p-n junction diode and Zener diodes.
2. Understand the operation of BJTs, JFETs and MOSFETs.
3. Know the applications of p-n junctions, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Know the applications of operation differential amplifier.

UNIT I P-N JUNCTION DIODE 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown of p-n junctions. Operation and I-V characteristics of Zener diodes. Tunnel diodes, Varactor diodes, Metal-semiconductor junctions.

UNIT II TRANSISTORS 9 hours

BJTs: Structure, operation, and I-V characteristics of BJTs. Early effect in BJTs.
JFET: Structure, operation, and I-V characteristics of JFETs.
MOSFET: Structure, operation, and I-V characteristics of MOSFETs. Channel length modulation in MOSFETs.

UNIT III APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown junctions: Half wave, full wave and bridge rectifiers. Clipping and clamping circuits. Voltage regulator circuit using Zener diodes.
BJTs: BJT as an amplifier and a switch. Biasing in BJT amplifier circuits.
MOSFETs: MOSFET as an amplifier and a switch. Biasing in MOSFET amplifier circuits.

UNIT IV OPERATIONAL AMPLIFIERS 9 hours

Principle of operation differential amplifier, calculation of differential gain, common mode gain and CMRR – DC and AC characteristics, Inverting – Non-inverting amplifier – Summing and difference amplifiers, Integrators and Differentiators circuits.

UNIT V APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

Nonlinear Op-amp circuits: Log and antilog Amplifiers, Analog switch - Sample and Hold circuit Analog multipliers, Precision rectifiers, - Comparators and Schmitt Trigger - Active filters.

Course Outcomes:

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

1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. D. Neamen and D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

2. B.G. Streetman and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2016.

Reference Books

1. S. M. Sze and K. K. Ng, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2007.
2. A. S. Sedra and K. C. Smith, "Microelectronic Circuits: Theory and Applications", 6th edition, Oxford Press, 2013.
3. J. Millman and A. Grabel, "Microelectronics", 2nd edition, McGraw-Hill.

4. Paul Scherz and Simon monk "Practical electronics for inventors" 4th edition, McGraw-Hill Education, 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE102 COMPUTER COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:

This course describes develop an understanding of modern network architectures from a design and performance perspective. The course also introduces concepts of working of the internet by introducing layered architectures of OSI and TCP/IP.

Course Objectives:

This course enables students to

1. To develop an understanding of modern network architectures.
2. To acquire knowledge and understanding on data flow, error control, MAC layer.
3. To understand the basics of masking in Network layer required for CCN.
4. To acquire the knowledge involved protocols related to Transport Layer.
5. To understand the requirement of distinct client-server model, DNS, FTP, HTTP, cryptography etc to be applicable in large CCN.

UNIT I DATA COMMUNICATION COMPONENTS 9 hours

Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT II DATA LINK LAYER AND MEDIUM ACCESS LAYER 9 hours

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT III NETWORK LAYER 9 hours

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT IV TRANSPORT LAYER 9 hours

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT V APPLICATION LAYER 9 hours

Client Server Model, Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Cryptography.

Course Outcomes:

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

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application with cloud and TCP/IP Model.

Text Book(s)

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference Books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE103 ANALOG AND DIGITAL COMMUNICATIONS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:

This course is to provide a basic introduction to analog digital communications. Topics include understanding of analog continuous wave modulation and evaluate the performance of these systems in the presence of noise; study of various analog and digital pulse modulation schemes; principle of digital baseband and pass band communication systems, channel coding and equalization techniques to improve the system performance.

Course Objectives:

This course enables students to

1. To study the fundamental concepts of communication theory.
2. To analyze various analog continuous wave modulation and pulse modulation techniques.
3. To evaluate the performance of analog communication systems in the presence of noise.
4. To study different baseband and bandpass digital modulation techniques.
5. To study the performance of digital receivers.

UNIT I NOISES ANALYSIS 9 hours

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

UNIT II ANALOG MODULATION 9 hours

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Frequency Division Multiplexing. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT III DIGITAL KEYING TECHNIQUES 9 hours

Pulse modulation, Sampling process. PAM, PPM, PWM and Pulse code modulation (PCM), Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers. Differential pulse code modulation and Adaptive PCM. Delta modulation.

UNIT IV SHIFT KEYING TECHNIQUES 9 hours

Baseband Pulse Transmission- Matched Filter – Error rate- Inter-Symbol Interference and Nyquist criterion. Pass band Digital Modulation Schemes-Passband Transmission Model- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Minimum Shift Keying.

UNIT V SIGNALS CONDITIONING 9 hours

Linear Block Codes- Convolutional codes- Linear equalization and Decision Feedback techniques for band-limited channels- Adaptive Equalization- Synchronization and Carrier Recovery for Digital modulation.

Course Outcomes:

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

1. Analyze the analog continuous wave modulation techniques in time and frequency domain.
2. Evaluate the performance of continuous wave modulation systems in the presence of noise.
3. Study of various analog and digital pulsed modulation techniques.
4. Understand of various digital baseband and bandpass modulation techniques.
5. Study of improvement in the performance of digital communication system using channel coding and equalization technique.

Text Book(s)

1. Simon Haykin and Michale Moher, “An Introduction to Analog and Digital Communications”, 2nd Edition, John Wiley and Sons, 2007.
2. B. P. Lathi and Zhi Ding, “Modern Analog and Digital Communication Systems”, 4th Edition, Oxford University Press, 2010.
3. Simon Haykin and Michale Moher, “Communication Systems”, 4th Edition, John Wiley and Sons, 2004.

Reference Books

1. H. P. Hsu, “Theory and Problems of Analog and Digital Communications”, 3rd Edition, Schaum’s Outline, 2009.
2. Proakis J. G. and Salehi M., “Communication Systems Engineering”, Pearson Education, 2002.
3. Taub H. and Schilling D.L., “Principles of Communication Systems”, Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., “Principles of Communication Engineering”, John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., “Digital Communication”, Kluwer Academic Publishers, 2004.
6. Proakis J.G., “Digital Communications”, 4th Edition, McGraw Hill, 2000

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE104 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course gives an introduction to Satellite Communication Systems which combines diverse topics like radio-wave propagation, antennas, modulation, demodulation, coding, orbital mechanics etc. The spacecraft link analysis and link design will be dealt in detail. The various satellite access techniques like FDMA, TDMA and CDMA will be analyzed from bandwidth utilization and throughput capability. The Indian National Satellite System (INSAT) will be covered in detail giving its specifications, features and services provided. The INTELSAT and other programs will also be covered. The VSAT, Mobile satellite communication and Personal Satellite communication will be discussed. The principles of Global Positioning System (GPS) principles, GPS receivers and its applications would be covered. The regulatory and interference issues will also be covered.

Course Objectives:

This course enables students to

1. To make the students understand the basic concept in the field of Satellite Communication and to know how to place a satellite in an orbit.
2. To calculate the link power budget.
3. To get a complete knowledge about the earth and space subsystems
4. To gain knowledge about the Satellite Access schemes
5. To gain knowledge about the Satellite system and mobile services provided

UNIT I INTRODUCTION AND SATELLITE SUBSYSTEMS 9 hours

Historical background, Overview of satellite communications, Orbital Mechanics, Useful orbits for satellite communications, look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance. Satellite Subsystems: Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification.

UNIT II MODULATION, MULTIPLEXING, MULTIPLE ACCESS TECHNIQUES AND TRANSMISSION THEORY 9 hours

Frequency Modulation (FM), Analog FM transmission by satellite, Digital Transmission, Digital Modulation and Demodulation, Bit and symbol error rates BPSK, QPSK, Digital transmission of analog signals, Time division Multiplexing (TDM), Frequency division multiple access (FDMA) Time Division multiple access (TDMA) frame structure, examples. Satellite switched TDMA onboard processing, DAMA, code division multiple access (CDMA), spread spectrum transmission and reception. Basic transmission theory, EIRP, system noise temperature and G/T ratio, design of down links, uplink design.

UNIT III EARTH STATIONS AND RADIO WAVE PROPAGATION EFFECTS 9 hours

Earth Stations: Introduction, transmitters, receivers, Antenna and feed systems, tracking systems, network interface subsystem, monitoring and auxillary equipment. Radio wave propagation effects & Impact on Satellite Links: Quantifying attenuation and depolarization, Atmospheric absorption, Cloud attenuation, Rain and ice effects, Prediction of rain attenuation, prediction of XPD, Propagation of Impairment countermeasures.

UNIT IV COMMERCIAL SATELLITE SYSTEMS AND VAST SYSTEMS 9 hours

INSAT, INTELSAT and EUTELSAT programmes: Services and salient features VSAT Systems: Overview, Network Architecture, access control protocols, basic techniques, VSAT earth station engineering, calculation of Link margins for VSAT star network, System design procedure example, new developments.

UNIT V MOBILE SATELLITE COMMUNICATIONS, NON-GEOSTATIONARY SATELLITE ORBIT (NGSO) SYSTEMS AND GPS **9 hours**

Mobile Satellite Communications and Non-Geostationary Satellite Orbit (NGSO) Systems: The third generation satellite communication, the need for mobile and personal communication, NGSO considerations, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs. Satellite Navigation and The Global Positioning System (GPS):Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, differential GPS.

Course Outcomes:

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

1. Explain the principles, concepts and operation of satellite communication systems.
2. Describe the concepts of signal propagation affects, link design, rain fading and link availability and perform interference calculations.
3. Understand modulation techniques and error correction codes for satellite communication.
4. Use software tools to simulate and analyze the performance of satellite communication systems and use real satellite up/down links (subject to the availability of satellite links) to conduct link experiments.
5. Critically analyze the design requirements and the performance of satellite communication systems, including the GPS systems.

Text Book(s)

1. T. Pratt, C. W. Bostian and J. E. Allnutt, “Satellite Communications,” Wiley India, 2nd ed., 2006.

2. Dennis Roddy, “Satellite” Forth edition, Tata McGraw-Hill, Special Indian edition, 2009.

Reference Books

1. Global Navigation satellite systems - B. S. Rao (TMH).

2. G. Maral and M. Bousquet, “Satellite Communications Systems—Systems, Techniques and Technology” John Wiley & Sons, 5thedition, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE105 OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course provides details about light propagation in fibers, attenuation and dispersion in fibers, generation of light chirp and hopping signals, design of optical receiver, design of fiber amplifier and design of time division and wave length division systems.

Course Objectives:

This course enables students to

1. Enumerate the theoretical aspects of light transmission in optical fiber.
2. Understand optical sources, detectors and amplifiers.
3. Understand TDM and WDM systems.
4. Study the characteristics of optical fiber, sources and detectors.
5. Estimate optical link budget consisting of optical sources, fibers and detectors.

UNIT I OPTICAL FIBERS — 9 hours

Ray Theory transmission. Optical Confinement, cutoff condition, single mode/multimode concept. Losses and Dispersion in optical fibers: Attenuation, Material Absorption Losses in Silica Glass Fibers, Linear Scattering Losses, Fiber Bend Loss, Non Linear effects in optical fibers-SRS, SPM, SBS, FWM Dispersion, Chromatic dispersion, Intermodal dispersion, Overall fiber dispersion, Polarization. Chirped Gaussian pulses, Broadening of chirped Gaussian pulses, controlling the dispersion profile.

UNIT II OPTICAL SOURCES — 9 hours

Light Emitting Diodes (LEDs): LED Structures, Light Source Materials, Quantum efficiency and LED Power, Modulation of LED. LASER Diodes- Laser Diode Modes, laser action, mode selection and Threshold Conditions, Some Injection laser structures-Gain guided lasers, index guided lasers, quantum well lasers, quantum dot lasers, Single frequency injection lasers-Short and coupled cavity lasers, distributed feedback lasers, vertical cavity surface emitting lasers, Injection laser characteristics, Threshold current dependence, Dynamic response, Frequency Chirp, noise, mode hopping, Reliability.

UNIT III PHOTO DETECTORS — 9 hours

Physical principles of photo diodes, photo detector noise, detector response time, avalanche multiplication noise, structures for InGaAs APDs, temperature effect on avalanche gain, Receiver design, S/N estimation, Digital optical receivers, Digital receiver sensitivity, comparisons of photo detectors. Design issues, S/N and BER optimization, Practical receiver.

UNIT IV OPTICAL AMPLIFIERS — 9 hours

Optical amplifiers-Semi-conductor optical amplifiers-performance characteristics, gain clamping, quantum dots, Fiber and waveguide amplifiers- Rare earth fiber amplifiers, Raman and Brillouin amplifiers, Wave guide amplifiers and fiber amplifiers, optical parametric amplifiers, wideband fiber amplifiers, Semi-conductor laser amplifiers- SLA, Design and applications of amplifiers.

UNIT V MULTIPLEXING CONCEPTS AND OPTICAL SYSTEMS — 9 hours

WDM Concepts and components: Over-view, Passive optical couplers, Isolators & circulators, Fiber grating filters, dielectric thin film filters, and Phased array based devices, Diffraction gratings, Active optical components, tunable light sources. Time Division Multiplexing- Optical TDM techniques, Soliton communication- Solition generation, solution interaction, High capacity solution systems and jitter eduction, WDM solution system- Solition Multiplexing techniques, new trends in optical communication. Optical Systems: Point to point links, power penalties, and error control. Power penalty considerations and link budget analysis. Different topologies used in optical networks, optical LAN, WANS, SONET/SDH, WDM light wave system- Channel spacing decision, multipliers, design issues.

Course Outcomes:

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

1. Understand the structures of Optical fibers and its types.
2. Estimate attenuation and dispersion in optical fiber.
3. Describe various optical sources and detectors for communication applications.
4. Analyze the characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusion.
5. Evaluate optical link budget consisting of optical sources, fibers and detectors.

Text Book(s)

1. Govind P Agrawal, Fiber -optic Communication systems, Willey Publication 4th Edition, 2010.

2. Gerdkeiser, Optical fiber communications, McGraw Hill International Edition, 5th Edition, 2013.

3. John M. Senior, Optical fiber communications, PHI, 4rd Edition, 2010.

Reference Books

1. Max Ming-Kang Liu, Principles and Applications of Optical Communications, TMH, 2010.

2. S. C. Gupta, Text book on optical fiber communication and its applications PHI, 3rd Edition 2005.

3. Satish Kumar, Fundamentals of Optical Fiber communications, PHI, 2nd Edition, 2014.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE201 ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite **None**

Course Objectives:

This course enables students to

1. To learn the basics of communication systems.
2. Have hands on the various analog and digital modulation systems.

LIST OF EXPERIMENTS

1. Amplitude Modulation and demodulation.
2. DSB-SC modulation and demodulation.
3. SSB-SC modulation and demodulation.
4. Frequency Modulation and demodulation.
5. Pre-emphasis and De-emphasis.
6. Phase modulation and demodulation.
7. Study and simulation of signals in the presence of noise.
8. Sampling and Reconstruction.
9. Pulse Amplitude Modulation and Time Division Multiplexing.
10. Pulse Code Modulation & demodulation and Differential PCM modulation & demodulation.
11. Quadrature Phase Shift Keying and Quadrature Amplitude Modulation.
12. Line Coding, Performance of Unipolar and Bipolar systems.
13. FSK, PSK and DPSK schemes.

Course Outcomes:

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

1. Understand the fundamental concepts of communication systems.
2. To analyse various analog and pulse modulation schemes.
3. To study the performance of communication systems in the presence of noise.
4. To analyse different digital modulation schemes & identify their application.
5. Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE106 MOBILE TELECOMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This course describes about accessing methods and modeling RF channel in cellular networks. It also describes 3G Technologies: CDMA and UMTS and LTE

Course Objectives:

This course enables students to

1. To model RF channel with fading for cellular applications.
2. To understand various cellular data networks.
3. To understand CDMA Architecture.
4. To Understand UMTS for 3G and LTE Cellular network.
5. To Understand OFDM on Mobile communication

UNIT I INTRODUCTION TO WIRELESS COMMUNICATION NETWORKS AND MULTIPLE ACCESS NETWORKS 9 hours

Concepts of Wireless, Mobile and Portable Networks, Cellular concept TDMA, FDMA, Spread spectrum multiple access: FHMA, CDMA, Space division multiple access, Carrier Sense Multiple Access, Packet radio, Overview of SS7 Network Signaling

UNIT II CELLULAR CONCEPT & PROPAGATION MECHANISM & TELE-TRAFFIC ENGINEERING 9 hours

Cellular system design, Frequency reuse, handoff, Interference and system capacity, Capacity Expansion Techniques- Cell splitting, Cell sectoring, roaming issues, Introduction to radio wave propagation, Reflection, diffraction and scattering, Modulation, coding, spread spectrum, fading and multipath, parameters of mobile multipath channels, Rayleigh and Ricean distributions, Link budget design, models of propagation both indoor and outdoor.

UNIT III GERAN GSM DATA SERVICES, GPRS, EDGE 9 hours

GSM architecture and Interfaces, Radio Link features, Logical channels and frame structure, speech coding, message, services and call flow Reference architecture of GPRS (SGSN, GGSN), EDGE Rel’99, Evolution of GERAN standardization Privacy and security in GSM, Security algorithms

UNIT IV CDMA ARCHITECTURE AND STANDARDS 9 hours

Frequency and channel specifications, forward CDMA channel, Spreading codes, IS-95, F.L. and R.L. channel generation, power control, Rake receiver, soft handoff, call processing, US PCM and ISM bands, 1X EVDO, 1X EVDV , WCDMA and CDMA 2000 and Differences between WCDMA and CDMA .

UNIT V UMTS 3G EVOLUTION PATH & CURRENT TRENDS IN MOBILE NETWORKS 9 hours

UTRAN architecture, UMTS physical layer, UMTS core network architecture, LTE — 4G Key Enablers for LTE 4G — OFDM, SC-FDE, SC-FDMA, Channel Dependant Multiuser Resource Scheduling, Multi-Antenna Techniques, Flat IP Architecture, LTE Network Architecture. Multi-Carrier Modulation — Multicarrier concepts, OFDM Basics, OFDM in LTE, Timing and Frequency Synchronization, Peak to Average Ration, SC- Frequency Domain Equalization, Computational Complexity Advantage of OFDM and SC-FDE

Course Outcomes:

After completing this Unit, students will be able to
1. Model RF channel with fading for cellular applications
2. Describe various cellular data networks.
3. Describe and compare TDMA, FDMA and CDMA Architecture
4. Specify OFDM and MIMO technologies for UMTS mobile networks.
5. Analyze different physical & protocol architectures of various Mobile Data Networks

Text Book(s)

1. Theodore. S. Rappaport, "Wireless Communication Principles and Practice" Second Ed. Pearson Education, Asia 2002.
2. Jochen H. Schiller, Addison –Wesley, "Mobile Communication", Pearson Education Ltd., 2000.
3 Arunabha Ghosh, Jan Zhang, JeffereyAndrews, Riaz Mohammed, "Fundamentals of LTE" Pearson Education Ltd.

Reference Books

1. Vijay Garg and Joseph Wilkes, "Principles and applications of GSM", Pearson Education, Asia 2002
2. Vijay Garg, "Wireless communication and networking", Morgan Kaufmann publishers, Imprint of Elsevier, 2008

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

.

Minor

20MDECE107 DSP INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

The main purpose of this course is to present a comprehensive approach to system design and implementation of DSP systems using advanced VLSI technologies. This Course emphasis on DSP algorithms, digital filters, finite word length effects, circuit architectures for an efficient implementation of asynchronous serial processing elements.

Course Objectives:

This course enables students to

1. Understand VLSI process, CMOS technologies, describe signals mathematically and understand how to perform mathematical operations on signals.
2. Learn fundamentals of DSP processors and multiple DSP algorithms.
3. Utilize knowledge of digital filters and finite word length effects, Multirate signal processing and application.
4. Understand DSP system architecture and map DSP algorithm to hardware.
5. Gain fundamental knowledge in IC design relevant for DSP industries.

UNIT I DSP IC'S AND VLSI CIRCUIT TECHNOLOGIES 9 hours

Standard digital signal processors, Application specific IC's for DSP, DSP systems, DSP system design, Integrated circuit design. MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

UNIT II DIGITAL SIGNAL PROCESSING 9 hours

Digital signal processing, Sampling of analog signals, Selection of sample frequency, Signalprocessing systems, Frequency response, Transfer functions, Signal flow graphs, Filter structures, Adaptive DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

UNIT III DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS 9 hours

FIR filters, FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures, Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations, Scaling of signal levels, Round-off noise, Measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

UNIT IV DSP ARCHITECTURES AND THEIR SYNTHESIS 9 hours

DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PEs.

UNIT V ARITHMETIC UNITS AND IC DESIGN 9 hours

Conventional number system, redundant Number system, Residue Number System. Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift accumulator, Layout of VLSI circuits, FFT processor, DCT processor and nterpolator as case studies.

Course Outcomes:

After completing this Unit, students will be able to

1. Carry out research and development in the IC design for various DSP applications.
2. Learn various DSP algorithms including adaptive ones.
3. Design the system architecture for various DSP algorithms.
4. Synthesize ICs from font-end to back-end for DSP algorithms.
5. Design ICs for fabrication to serve different DSP industries.

Text Book(s)

1. Lars Wanhammer, "DSP Integrated Circuits", Academic press, New York, 1999.
2. Robert J. Schilling, "Fundamentals of Digital Singal Processing using MATLAB", Perason Education, 2010.

Reference Books

1. A.V.Oppenheim et.al, "Discrete-time Signal Processing", Pearson education, 2000.
2. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital signal processing – A practical approach", 2nd Edition, Pearson edition, Asia, 2011.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor in Electronics & Communication Engineering
Stream Name: Embedded Systems (ES)

Minor

20MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course explores semiconductor physics, and operation & applications of semiconductor devices such as p-n junctions, BJTs, and MOSFETs. It also covers operational amplifiers and applications of operational amplifiers.

Course Objectives:

This course enables students to

1. Understand the operation of the basic semiconductor diodes, i.e., the p-n junction diode and Zener diodes.
2. Understand the operation of BJTs, JFETs and MOSFETs.
3. Know the applications of p-n junctions, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Know the applications of operation differential amplifier.

UNIT I P-N JUNCTION DIODE 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown of p-n junctions. Operation and I-V characteristics of Zener diodes. Tunnel diodes, Varactor diodes, Metal-semiconductor junctions.

UNIT II TRANSISTORS 9 hours

BJTs: Structure, operation, and I-V characteristics of BJTs. Early effect in BJTs.
JFET: Structure, operation, and I-V characteristics of JFETs.
MOSFET: Structure, operation, and I-V characteristics of MOSFETs. Channel length modulation in MOSFETs.

UNIT III APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown junctions: Half wave, full wave and bridge rectifiers. Clipping and clamping circuits. Voltage regulator circuit using Zener diodes.
BJTs: BJT as an amplifier and a switch. Biasing in BJT amplifier circuits.
MOSFETs: MOSFET as an amplifier and a switch. Biasing in MOSFET amplifier circuits.

UNIT IV OPERATIONAL AMPLIFIERS 9 hours

Principle of operation differential amplifier, calculation of differential gain, common mode gain and CMRR – DC and AC characteristics, Inverting – Non-inverting amplifier – Summing and difference amplifiers, Integrators and Differentiators circuits.

UNIT V APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

Nonlinear Op-amp circuits: Log and antilog Amplifiers, Analog switch - Sample and Hold circuit Analog multipliers, Precision rectifiers, - Comparators and Schmitt Trigger - Active filters.

Course Outcomes:

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

1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. D. Neamen and D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

2. B.G. Streetman and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson, 2016.

Reference Books

1. S. M. Sze and K. K. Ng, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2007.
2. A. S. Sedra and K. C. Smith, “Microelectronic Circuits: Theory and Applications”, 6th edition, Oxford Press, 2013.
3. J. Millman and A. Grabel, “Microelectronics”, 2nd edition, McGraw-Hill.

4. Paul Scherz and Simon monk “Practical electronics for inventors” 4th edition, McGraw-Hill Education, 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE108 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
This course provides computer architecture, instruction set design, memory organization, ALU operations, I/O interfaces and multi computing systems.

Course Objectives:
This course enables students to
1. To provide an introduction to concepts in computer architecture.
2. Impart knowledge on design aspects, system resources such as memory technology and I/O subsystems needed to achieve increase in performance.
3. Acquaint the students with current trends in computing architecture.

UNIT I INTRODUCTION TO COMPUTERS 9 hours

Introduction to computer abstractions and technology, CPU performance, the power wall, Switch from uniprocessors to multiprocessors.

UNIT II INSTRUCTIONS 9 hours
instructions, Logical operations, Instructions for making decisions, Supporting procedures in computer hardware, Communicating with people, MIPS architecture and instruction set.

UNIT III PIPELINE ARCHITECTURES 9 hours
Logic design conventions, data path design, a simple implementation scheme, Control hardware, Pipelining overview, Pipelined data-path and control.

UNIT IV ARITHMETIC OPERATIONS 9 hours
Addition, Subtraction, Multiplication, Division, Floating point arithmetic, Parallelism and Computer Arithmetic, Floating point in the x86, Forwarding versus stalling, Control hazards, Exceptions, Branch prediction.

UNIT V MEMORY ORGANIZATIONS & MULTI-PROCESSORS 9 hours
Introduction to memory organization, Basics of caches, cache performance, Virtual memory, Introduction to Storage, Dependability reliability and Availability, Disk storage, Flash storage, Connecting processors memory and I/O devices, Interfacing I/O devices, Introduction to multicores ,multi-processors and clusters, Creating parallel processing programs, Shared memory multiprocessors, Clusters and other message passing multiprocessors, Hardware multi-threading, SISD, MIMD,SIMD,SPMD, Vector.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. Patterson, D.A. & J.L. Hennessy, Computer Organization and Design, Elsevier, 4th ed.,2009.

2. William Stallings, Computer Organisation & Architecture, Pearson, 8th ed., 2010.

Reference Books

1. Patterson, D.A. & J.L. Hennessy Computer Architecture: A Quantitative Approach,5th Edition, 2012.

2. Hamacher et. al, Computer Organisation, McGraw Hill, 5th ed., 2002.

3. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson.

4. M.Moris Mano ,Computer Systems Architecture , 3rd Edition,Pearson/PHI.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE109 ADVANCED MICROPROCESSORS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:
This course facilitates the students to familiar with Advanced Microprocessors and its applications. Course covers the Introduction to the Intel 80186/80188, Programming the 80186/8018, Introduction to the 80286, 80386 & 80486. The course also includes the advanced Pentium processors introductions and Pentium Pro introductions.

Course Objectives:
This course enables students to
1. Understand the RISC-V architecture and its advantages.
2. Master the RISC-V base integer instruction set and addressing modes.
3. Develop RISC-V assembly programming skills
4. Familiarity with RISC-V development tools and simulators
5. Analyze real-world applications of RISC-V

UNIT I INTRODUCTION TO RISC-V AND ASSEMBLY PROGRAMMING 9 hours
Overview of RISC-V architecture and its advantages, RISC-V base integer instruction set and addressing modes, Writing RISC-V assembly programs, Introduction to RISC-V development tools and simulators

UNIT II RISC-V PIPELINE AND PERFORMANCE OPTIMIZATION 9 hours
RISC-V pipeline stages and data hazards, Pipeline optimizations (e.g., forwarding, speculation), Techniques for improving instruction throughput and reducing stalls.

UNIT III RISC-V MEMORY SYSTEM AND CACHES 9 hours
Memory hierarchy in RISC-V systems, Cache memory organization and replacement policies, Virtual memory and address translation in RISC-V

UNIT IV RISC-V EXTENSIONS AND PARALLEL PROCESSING 9 hours
Overview of RISC-V standard extensions (e.g., RV32I, RV64I),RISC-V vector extension (RV32V, RV64V),SIMD (Single Instruction, Multiple Data) processing in RISC-V

UNIT V MULTI-CORE RISC-V PROCESSORS AND ADVANCED TOPICS 9 hours
Introduction to multi-core RISC-V processors, Interconnects and communication between cores, Advanced topics such as hardware security extensions and transactional memory in RISC-V.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Describe the key features and advantages of the RISC-V architecture compared to other instruction set architectures.
2. Describe the stages of the RISC-V pipeline and their respective functions in the instruction execution process.
3. Describe the memory hierarchy in RISC-V systems, understanding the different levels of memory and their respective roles in the memory system.

4. Assess the impact of incorporating specific RISC-V extensions on overall program performance, considering factors such as instruction mix and data dependencies.
5. Describe the architecture and design principles of multi-core RISC-V processors, understanding how they enable parallel processing and improve performance..

Text Book(s)

1. Patterson, David, and Andrew Waterman. The RISC-V Reader: an open architecture Atlas. Strawberry Canyon, 2017.
2. Waterman, Andrew, Yunsup Lee, David A. Patterson, and Krste Asanovic. "The risc-v instruction set manual, volume i: Base user-level isa." EECS Department, UC Berkeley, Tech. Rep. UCB/EECS-2011-62 116 (2011): 1-32.

Reference Books

1. Patterson, David. "Computer organization and design RISC-V edition: the hardware." 2017.
2. RISC-V ASSEMBLY LANGUAGE Programmer Manual Part I, developed by: SHAKTI Development Team @ iitm ’20, shakti.org.in. https://shakti.org.in/documentation.html, 2020.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE110 MICROCONTROLLER PROGRAMMING WITH TI- MSP 430

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:

This course introduces the concept of embedded system and gives introduction to the students about the Texas Instruments MSP430 architecture, interfacing techniques, peripheral details and communication model of the Texas Instruments MSP430.

Course Objectives:

This course enables students to

1. Understand the basic of MSP430.
2. Study the Architecture of the MSP430 Processor, different instruction sets.
3. Know the port programming and interfacing techniques.
4. Understand the timer and counter of MSP 430.
5. Study the different communication buses used.

UNIT I THE TEXAS INSTRUMENTS MSP430 9 hours

What (and Where) Are Embedded Systems? Approaches to Embedded Systems, Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Memory, Software, Where Does the MSP430 Fit? The Outside View—Pin-Out, The Inside View—Functional Block Diagram, Memory, Central Processing Unit, Memory-Mapped Input and Output Clock Generator, Exceptions: Interrupts and Resets, Where to Find Further Information.

UNIT II ARCHITECTURE OF THE MSP430 PROCESSOR 9 hours

Central Processing Unit, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Examples Reflections on the CPU and Instruction Set, Resets, Clock System, Functions, Interrupts, and Low-Power Modes, Functions and Subroutines, Storage for Local Variables, Passing Parameters to a Subroutine and Returning a Result, Mixing C and Assembly Language, Interrupts- Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation.

UNIT III PORT PROGRAMMING 9 hours

Digital Input and Output: Parallel Ports, Digital Inputs, Switch De-bounce, Digital Outputs, Interface between 3V and 5V Systems, Driving Heavier Loads, Liquid Crystal Displays, Driving an LCD from an MSP430x4xx, Simple Applications of the LCD.

UNIT IV WATCHDOG TIMER 9 hours

Basic Timer1, Timer-A, Measurement in the Capture Mode, Output in the Continuous Mode, Output in the Up Mode: Edge-Aligned Pulse-Width Modulation, Output in the Up/Down Mode: Centered Pulse-Width Modulation, Operation of Timer-A in the Sampling Mode.

UNIT V COMMUNICATIONS WITH MSP-430 9 hours

Analog-to-Digital Conversion: General Issues, Analog-to-Digital Conversion: Successive Approximation, the ADC10 Successive-Approximation ADC9.5 Basic Operation of the ADC10, Digital-to-Analog Conversion, Serial Peripheral Interface, SPI with the USI, SPI with the USCI, A Simple I²C Master with the USCI_B0 on a FG4618.

Course Outcomes:

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

1. Demonstrate the basic of MSP430.
2. Explain the components of MSP430 Processor architecture and different instruction sets.
3. Design the port programming and interfacing techniques.
4. Design the timer and counter for various modulation schemes of MSP 430.
5. Explain the different communication buses used in MSP430.

Text Book(s)

1. Introduction to Embedded Systems- K V Shibu , McGraw Hill-2007.

2. MSP430 Microcontroller Basics - John Davies, Elsevier, 2008.

Reference Books

1. Embedded Systems Design Using the TI MSP430 Series, 1st Edition - Chris Nagy, Elsevier, 2003.
2. Analog and Digital Circuits for Electronic Control System Applications-Using the TI

3. MSP430 Microcontroller- Jerry Luecke, Elsevier, 2004.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE111 ARM – SYSTEM ON CHIP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course gives introduction to the students to understand the ARM processor architecture, interfacing techniques, peripheral details and communication model of the ARM Processor Cores.

Course Objectives:

This course enables students to

1. Study the basic of ARM processor and different instruction sets and pipelining.
2. Study the advanced instruction sets Know the different instruction sets and pipelining
3. Understand the architectural support for high level languages.
4. Understand the architectural support for system development.
5. Know the different ARM Processor cores.

UNIT I ARM ARCHITECTURE AND ITS ASSEMBLY LANGUAGE PROGRAMMING 9 hours

The Reduced Instruction Set Computer, The Acorn RISC Machine, Architectural inheritance, The ARM programmer's model, ARM development tools. Data processing instructions, Data transfer instructions, Control flow instructions, 3-Stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.

UNIT II THUMB INSTRUCTION SETS 9 hours

Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, The Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, Thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb breakpoint instruction..

UNIT III ARCHITECTURAL SUPPORT FOR HIGH-LEVEL LANGUAGES 9 hours

Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, Use of memory, Run-time environment.

UNIT IV ARCHITECTURAL SUPPORT FOR SYSTEM DEVELOPMENT 9 hours

ARM memory interface, Advanced Microcontroller Bus Architecture (AMBA), ARM reference peripheral specification, Hardware system prototyping tools, ARMulator, JTAG boundary scan test architecture, ARM debug architecture, Embedded Trace, Signal processing support.

UNIT V ARM PROCESSOR CORES 9 hours

ARM7TDMI organization, Hardware interface, Clock control, Memory interface, Bus control, Debug support, Debug interface, ARM7TDMI applications, ARMS, ARM9TDMI, ARM9TDMI organization, ARM10TDMI.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Explain the ARM architecture and describe the different instruction sets and pipelining.
2. Describe the advanced instruction sets.
3. Design the Architectural Support for High-Level Languages.
4. Describe the Architectural Support for System Development.
5. Explain the different ARM Processor cores.

Text Book(s)

1. Michael J. Flynn and Wayne Luk, "Computer System Design System-on-Chip", Wiley India Pvt. Ltd.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.

Reference Books

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)", Newnes, BK and CDROM.
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE202 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite **None**

Course Objectives:

This course enables students to

1. To understand the different types of instruction sets, addressing modes of 8086
2. To study the architecture of MSP-430.

LIST OF EXPERIMENTS

Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs

Part B: Embedded C Experiments using MSP430 Microcontroller

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430

Course Outcomes:

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

1. Program the MSP430 for various applications
2. Design a embedded system for particular application using MSP430

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE112 REAL TIME OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This course emphasize to the students to understand the concepts of real time operating systems (RTOS). This course covers the different types of policies, multi-resource services and give embedded system components. It also covers the High availability and Reliability Design.

Course Objectives:

This course enables students to

1. Understand the introduction of real-time embedded systems
2. Know the different types of policies.
3. Understand the Multi-resource Services techniques.
4. Learn the Embedded System Components.
5. Know the embedded system design based on availability and reliability

UNIT I INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS 9 hours

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility. real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

UNIT II RTOS SCHEDULING AND PROCESS MANAGEMENT 9 hours

Uniprocessor Scheduling: Types of scheduling algorithms: FCFS, SJF, Priority, Round Robin UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept PROCESS MANAGEMENT: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

UNIT III MULTI-RESOURCE SERVICES& INTER-PROCESS COMMUNICATION 9 hours

Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Messages, Buffers, mailboxes, queues, semaphores. Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

UNIT IV EXCEPTIONS, INTERRUPTS AND TIMERS 9 hours

Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations. Debugging Components- Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self-test and diagnostics, External test equipment, Application-level debugging. Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations

UNIT V UNIT V: HIGH AVAILABILITY AND RELIABILITY DESIGN 9 hours

Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design trade-offs, Hierarchical applications for Fail-safe design.
Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Introduce real-time embedded systems
2. Describe the different types of policies.
3. Demonstrate the Multi-resource Services techniques.
4. Explain the Embedded System Components.
5. Explain the embedded system design based on availability and reliability.

Text Book(s)

1. Theodore. S. Rappaport, "Wireless Communication Principles and Practice" Second Ed. Pearson Education, Asia 2002.
2. Jochen H. Schiller, Addison –Wesley, "Mobile Communication", Pearson Education Ltd., 2000.
3 Arunabha Ghosh, Jan Zhang, JeffereyAndrews, Riaz Mohammed, "Fundamentals of LTE" Pearson Education Ltd.

Reference Books

1. Vijay Garg and Joseph Wilkes, "Principles and applications of GSM", Pearson Education, Asia 2002
2. Vijay Garg, "Wireless communication and networking", Morgan Kaufmann publishers, Imprint of Elsevier, 2008

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE113 TESTING OF DIGITAL VLSI CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This course will examine in depth the theory and practice of fault analysis, test generation, and design for testability for digital VLSI circuits and systems. Testing tools and systematic design-for-test (DFT) methodologies are necessary to handle design complexity, ensure reliable operation, and achieve short time-to-market. The topics to be covered in the course include: fault modeling; fault simulation; test generation algorithms; testability measures; design for testability and scan design; built-in self-test, delay testing; wafer-level burn-in and test; memory testing; system-on-a-chip test; test compression. Students will get a chance to use commercial DFT tools such as EncounterTest from Cadence, Fastscan from Mentor Graphics, and Tetramax from Synopsys

Course Objectives:

This course enables students to

1. Students will be able to design any digital system.
2. Students will learn the basics from simple transistor design to complex digital system.
3. This is a very industry oriented course, students learn various CAD tools used in the chip design industry.

UNIT I Basics of Testing and Fault Modeling 9 hours

Introduction to Testing - Faults in digital circuits -Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance -Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

UNIT II Test Generation for Combinational and Sequential Circuits 9 hours

Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

UNIT III Design For Testability 9 hours

Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches.

UNIT IV Self Test and Test Algorithms 9 hours

Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design – Test algorithms - Test generation for Embedded RAMs.

UNIT V Fault Diagnosis Logic 9 hours

Level Diagnosis -Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

Course Outcomes:

After completing this Unit, students will be able to
1. Students will be able to design any digital system.
2. Students will learn the basics from simple transistor design to complex digital system.
3. This is a very industry oriented course, students learn various CAD tools used in the chip design industry. The course makes the students highly employable in various IC design companies

Text Book(s)

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.

2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.

Reference Books

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.

2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors in Electronics & Communication Engineering

Honors

20HDECE101 MIXED SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Course Objectives:

This course enables students to

- Know the fundamentals of Signals, Filters and Sampling process
- Understand and Analyze the design techniques of analog filters Structures
- Know and Analyze the design techniques of digital filters Structures
- Describe the fundamental of conversion techniques for analog and digital signal Processing
- Distinguish various data convertor architectures

UNIT I SIGNALS, FILTERS AND SAMPLING 9 hours

Sinusoidal Signals, Comb Filters, Representing Signals, Impulse Sampling, Decimation, The Sample-and-Hold, Interpolation, K-Path Sampling, The Track-and-Hold Implementing the S/H, The S/H with Gain, The Discrete Analog Integrator.

UNIT II ANALOG FILTERS 9 hours

Integrator Building Blocks- Lowpass Filters, Active-RC Integrators, MOSFET-C Integrators, gm-C (Transconductor-C) Integrators, Discrete-Time Integrators, Filtering Topologies- The Bilinear Transfer Function, The Biquadratic Transfer Function.

UNIT III DIGITAL FILTERS 9 hours

SPICE Models for DACs and ADCs- The Ideal DAC, The Ideal ADC, Number Representation, Sinc-Shaped Digital Filters- The Counter, Lowpass Sinc Filters, Bandpass and Highpass Sinc Filters, Interpolation using Sinc Filters, Decimation using Sinc Filters, Filtering Topologies- FIR Filters, Stability and Overflow, The Bilinear Transfer Function, The Biquadratic Transfer Function.

UNIT IV DATA CONVERTER FUNDAMENTALS 9 hours

Analog Versus Discrete Time Signals, Converting Analog Signals to Digital Signals, Sampleand-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-toDigital Converter (ADC) Specifications, Mixed-Signal Layout Issues.

UNIT V DATA CONVERTER ARCHITECTURES 9 hours

DAC Architectures- Digital Input Code, Resistor String, R-2R Ladder Networks, Current Steering, Charge-Scaling DACs, ADC Architectures- Flash, The Two-Step Flash ADC, The Pipeline ADC, Integrating ADCs, The Successive Approximation ADC, The Oversampling ADC.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Recognize Signals, Filters and Sampling process of sinusoidal signals, including their mathematical representation and significance in signal processing.
- Design and analyze MOSFET-C integrator circuits, leveraging their properties for specific filtering requirements
- Understand the design and application of sinc-shaped digital filters, including their use in lowpass, bandpass, and highpass filtering.
- Gain a deep understanding of the principles and techniques involved in converting analog signals to digital signals, essential for effective data acquisition and processing.
- Develop expertise in designing and analyzing flash and two-step flash ADCs, focusing on their speed, resolution, and implementation challenges.

Text Books:

1. R. Jacob Baker, CMOS Mixed-Signal Circuit Design, A JOHN WILEY & SONS, Second Edition, 2008.
2. R. Jacob Baker, CMOS Circuit Design, Layout, and Simulation, A JOHN WILEY & SONS, Third Edition, 2010
3. S.Y.Kuang, H.J. White house, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1995.

Reference Books:

1. John G. Prakis "Digital Communication 4th Edition McGRAW HILL Publication 2012
2. Simon Waykin Digital Communication Johnwiley and sons 1998
3. Petre Stoica and Randolph L. Moses, Spectral Analysis of Signals. Prentice Hall. 2005

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

20HDECE102 TESTING OF DIGITAL VLSI CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102, 20ECE111**

Course Description:

Testing is one of the most expensive process in the design flow of a typical chip. There exists various errors e.g. design errors, fabrication defects, fabrication errors and physical failures. This course covers: Introduction to Testing, Test methods and Design for Testability

Course Objectives:

This course enables students to

1. To know the different types of faults and to study fault detection
2. To understand the concepts of test generation - DFT and BIST.
3. To study in detail about fault diagnosis, memory testing and PLA testing

UNIT I TESTING AND FAULT MODELING 9 hours

Introduction to testing - Faults in Digital circuits - Modeling of faults - Logical fault models - Fault detection - Fault location - Fault equivalence - Fault dominance, Logic simulation - Types of Simulation - Compiled code simulation - Gate level event driven simulation - Delay models

UNIT II TEST GENERATION 9 hours

Test generation for combinational circuits - Truth table and fault matrix method – Path sensitization algorithm - Boolean difference method - D – algorithm - PODEM algorithm - FAN algorithm , Testable combinational logic circuit design, Test generation for sequential circuits - Time frame expansion - Test generation based on circuit structure and state table.

UNIT III LOGIC BUILT-IN-SELF-TEST 9 hours

Test pattern generators - Exhaustive testing - Pseudo random testing - Pseudo exhaustive testing, Output response compression techniques - ones count - transition count – parity check - syndrome check - signature analysis, BIST architectures - Built-in-Evaluation and Self Test (BEST) - Self Testing Using MISR and Parallel SRSG (STUMPS) - Built In Logic Block Observer (BILBO) - Modified BILBO

UNIT IV DESIGN FOR TESTABILITY AND MEMORY TESTING 9 hours

Testability - Controllability and Observability, Adhoc Design for testability techniques, Generic Scan based designs - Full serial integrated scan - Isolated serial scan - Non- serial scan, Boundary scan architecture. Testing of RAM - RAM functional fault models - Test algorithms - Test generation for Embedded RAM

UNIT V FAULT DIAGNOSIS AND PLA TESTING 9 hours

Diagnosis by UUT reduction, Combinational logic diagnosis - Cause-Effect analysis - Effect-Cause analysis, Self-checking design, PLA Testing

Course Outcomes:

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

1. Demonstrate different types of fault models and fault simulation.
2. Acquire complete knowledge regarding test generation for combinational circuits and sequential circuits.
3. Demonstrate the concepts of BIST and their architectures.
4. Illustrate the concepts of DFT and memory testing.
5. Identify the fault location by diagnosis methods and design self checking circuits..

Text Book(s)

1. Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, "VLSI Test Principles and Architectures: Design for Testability", Morgan Kaufmann publishers, 2006.
2. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors

20HDECE103 DSP INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

The main purpose of this course is to present a comprehensive approach to system design and implementation of DSP systems using advanced VLSI technologies. This Course emphasis on DSP algorithms, digital filters, finite word length effects, circuit architectures for an efficient implementation of asynchronous serial processing elements.

Course Objectives:

This course enables students to

6. Understand VLSI process, CMOS technologies, describe signals mathematically and understand how to perform mathematical operations on signals.
7. Learn fundamentals of DSP processors and multiple DSP algorithms.
8. Utilize knowledge of digital filters and finite word length effects, Multirate signal processing and application.
9. Understand DSP system architecture and map DSP algorithm to hardware.
10. Gain fundamental knowledge in IC design relevant for DSP industries.

UNIT I DSP IC'S AND VLSI CIRCUIT TECHNOLOGIES 9 hours

Standard digital signal processors, Application specific IC's for DSP, DSP systems, DSP system design, Integrated circuit design. MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

UNIT II DIGITAL SIGNAL PROCESSING 9 hours

Digital signal processing, Sampling of analog signals, Selection of sample frequency, Signalprocessing systems, Frequency response, Transfer functions, Signal flow graphs, Filter structures, Adaptive DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

UNIT III DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS 9 hours

FIR filters, FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures, Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations, Scaling of signal levels, Round-off noise, Measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

UNIT IV DSP ARCHITECTURES AND THEIR SYNTHESIS 9 hours

DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PEs.

UNIT V ARITHMETIC UNITS AND IC DESIGN 9 hours

Conventional number system, redundant Number system, Residue Number System. Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift accumulator, Layout of VLSI circuits, FFT processor, DCT processor and nterpolator as case studies.

Course Outcomes:

After completing this Unit, students will be able to

1. Carry out research and development in the IC design for various DSP applications.
2. Learn various DSP algorithms including adaptive ones.
3. Design the system architecture for various DSP algorithms.
4. Synthesize ICs from font-end to back-end for DSP algorithms.
5. Design ICs for fabrication to serve different DSP industries.

Text Book(s)

1. Lars Wanhammer, "DSP Integrated Circuits", Academic press, New York, 1999.
2. Robert J. Schilling, "Fundamentals of Digital Singal Processing using MATLAB", Perason Education, 2010.

Reference Books

1. A.V.Oppenheim et.al, "Discrete-time Signal Processing", Pearson education, 2000.
2. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital signal processing – A practical approach", 2nd Edition, Pearson edition, Asia, 2011.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE104 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
Discrete random process, autocorrelation, autovaiance of the discrete random signal has been covered in the course. The spectrum estimation, linear estimation design included in the course. Also, filter design using adaptive techniques and multi-rate signal processing have been discussed.

Course Objectives:
This course enables students to
1. Understand the discrete random signal processing.
2. Study the spectrum estimation.
3. Understand the linear estimation and prediction.
4. Know the designing of adaptive filter.
5. Study the multi-rate signal processing.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9 hours

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Autocovariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density Periodogram, Spectral Factorization, Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II SPECTRUM ESTIMATION 9 hours

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin’s algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 9 hours

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9 hours

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9 hours

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- Direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system. Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Course Outcomes:

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

1. Recognise the discrete random signal processing.
2. Demonstrate different spectrum estimation techniques.
3. Realize the linear estimation and prediction.
4. Design the adaptive filter.
5. Analyse the multi-rate signal processing.

Text Book(s)

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons,Inc.,Singapore, 2002.

Reference Books

1. John G.Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
2. John G.Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
3. Dimitris G. Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.
4. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic)

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE105 SYSTEM ON CHIP DESIGN

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:
The system architecture, hardware & software design will be covered using SOC approach. The different processors, memory design for SOC will be covered. Also, the case studies of various applications will be included.

Course Objectives:
This course enables students to
1. Understand the introduction of SOC
2. Know the different types of processors.
3. Understand the memory design of SOC.
4. Learn the interconnect and customization.
5. Know the Application of SOC

UNIT I INTRODUCTION 9 hours

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT II PROCESSORS 9 hours

Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT III MEMORY DESIGN FOR SOC 9 hours

Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

UNIT IV INTERCONNECT CUSTOMIZATION AND CONFIGURATION 9 hours

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT V APPLICATION STUDIES / CASE STUDIES 9 hours

SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Course Outcomes:

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

1. Understand the introduction of SOC
2. Know the different types of processors.
3. Understand the memory design of SOC.
4. Learn the interconnect and customization.
5. Know the Application of SOC

Text Book(s)

1. Michael J. Flynn, Wayne Luk, Computer System Design: System on chip, Wiley-Blackwell, First Edition, 2011.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.

Reference Books

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)", Newnes, BK and CDROM.
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE106 LOW POWER VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This is a course on the design and applications of low power integrated circuits. This course introduces various strategies and methodologies for designing low power circuit and systems. It describes the many issues facing designers at architectural, logic, circuit and device levels and presents some of the techniques that have been proposed to overcome these difficulties.

Course Objectives:

This course enables students to

1. Identify sources of power in an IC
2. Identify the power reduction techniques based on technology independent and technology dependent
3. Design adders and special circuits with low power dissipation
4. Design multipliers and memory circuits with low power dissipation.
5. Identify suitable techniques to reduce the power dissipation.

UNIT I POWER DISSIPATION IN CMOS **9 hours**

Introduction: Need for low power VLSI chips, Sources of power consumption, Introduction to CMOS inverter power dissipation, Low power VLSI design limits, Basic principle of low power design

UNIT II POWER OPTIMIZATION **9 hours**

Logical Level Power Optimization: Gate reorganization, Local restructuring, Signal gating, Logic encoding, State machine encoding, Pre-computation logic

Circuit Level Power Optimization: Transistor and gate sizing, Equivalent pin ordering, Network restructuring and re-organization, Special latches and flip-flops

UNIT III DESIGN LOW POWER LOW VOLTAGE ADDERS AND SPECIAL CIRCUITS **9 hours**

Low Voltage Low Power Adders: Standard adder cells, CMOS adder's architecture, Low voltage low power design techniques, Current mode adders

Special Techniques: Power reduction and clock networks, CMOS floating gate, Low power bus, Delay balancing

UNIT IV DESIGN LOW POWER LOW VOLTAGE MULTIPLIERS AND MEMORIES **9 hours**

Low Voltage Low Power Multipliers: Overview of multiplication, Types of multiplier architectures, Braun multiplier, Baugh-Wooley multiplier, Booth multiplier, Wallace tree multiplier, Delay balancing in multipliers

Low Voltage Low Power Random Access Memories: Basics of SRAM and DRAM, Memory cell, Pre-charge and equalization circuit, Types of DRAM, Output latch

UNIT V SYNTHESIS FOR LOW POWER **9 hours**

Behavioral level transforms, Algorithm level transforms for low power, Architecture driven voltage scaling, Power optimization using operation reduction, Operation substitution, Bus switching activity

Course Outcomes:

Upon the completion of the course student will be able to

1. Apply lowpower design concepts to classify power dissipation mechanisms in CMOS integrated circuits
2. Classify various power optimization techniques at circuit and logic level.
3. Design lowpower low voltage adders and special circuits
4. Design lowpower low voltage multiplier and memory circuits using current generation design style.
5. Analyze different low power transforms and logic synthesis techniques.

Text Book(s)

1. Gary Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, 2008.

2. Kiat-Seng Yeo, Kaushik Roy, "Low Voltage Low power VLSI Subsystems", Tata McGraw Hill Publications, 2009.

Reference Books

1. Jan M. Rabaey, Massoud Pedram, "Low Power Design Methodologies", Kluwer Academic Publishers, 2010.
2. P. Chandrakasan, R.W. Broadersen, "Low Power Digital CMOS Design", Kluwer Academic Publishers, 1995.
3. S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE107 ADVANCED COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This course will cover the fundamental aspects of wireless networks, with emphasis on current and next-generation wireless networks. Various aspects of wireless networking will be covered including: fundamentals of cellular communication, mobile radio propagation, multiple access techniques, mobility support, channel allocation, Wireless PAN/LAN/MAN standards, mobile ad-hoc networks, wireless sensor networks, and routing in wireless and mobile networks. The goal of this course is to introduce the students to state-of-the-art wireless network protocols and architectures.

Course Objectives:

This course enables students to

- To study about advanced wireless network, LTE, 4G and Evolutions from LTE to LTE.
- To study about wireless IP architecture, Packet Data Protocol and LTE network architecture
- To study about adaptive link layer, hybrid ARQ and graphs routing protocol.
- To study about mobility management, cellular network, and micro cellular networks
- To Study about the QoS on IP networks

UNIT I INTRODUCTION 9 hours

Introduction to 1G/2G/3G/4G Terminology. Evolution of Public Mobile Services -Motivation for IP Based Wireless Networks -Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTEA - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties

UNIT II WIRELESS IP NETWORK ARCHITECTURES 9 hours

3GPP Packet Data Networks - Network Architecture - Packet Data Protocol (PDP) Context - Configuring PDP Addresses on Mobile Stations - Accessing IP Networks through PS Domain – LTE network Architecture - Roaming Architecture- Protocol Architecture- Bearer Establishment Procedure -Inter-Working with other RATs.

UNIT III ADAPTIVE LINK AND NETWORK LAYER 9 hours

Link Layer Capacity of Adaptive Air Interfaces-Adaptive Transmission in Ad Hoc Networks Adaptive Hybrid ARQ Schemes for Wireless Links-Stochastic Learning Link Layer Protocol Infrared Link Access Protocol-Graphs and Routing Protocols-Graph Theory-Routing with Topology Aggregation-Network and Aggregation Models

UNIT IV MOBILITY MANAGEMENT 9 hours

Cellular Networks-Cellular Systems with Prioritized Handoff-Cell Residing Time Distribution Mobility Prediction in Pico- and Micro-Cellular Networks

UNIT V QUALITY OF SERVICE 9 hours

QoS Challenges in Wireless IP Networks - QoS in 3GPP - QoS Architecture, Management and Classes -QoS Attributes - Management of End-to-End IP QoS - EPS Bearers and QoS in LTE networks.

Course Outcomes:

After completing this Unit, students will be able to

1. Familiar with the latest 4G networks and LTE
2. Understand about the wireless IP architecture and LTE network architecture.
3. Familiar with the adaptive link layer and network layer graphs and protocol.
4. Understand about the mobility management and cellular network.
5. Understand about the wireless sensor network architecture and its concept.

Text Book(s)

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, “Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach”, John Wiley & Sons, 2014.

2. Crosspoint Boulevard, “Wireless and Mobile All-IP Networks”, Wiley Publication, 2005.

Reference Books

1. Jyh-Cheng Chen and Tao Zhang, “IP-Based Next-Generation Wireless Networks Systems, Architectures, and Protocols”, John Wiley & Sons, Inc. Publication,2006.
2. Minoru Etoh, “Next Generation Mobile Systems3G and Beyond,” Wiley Publications,2005.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE108 CAD FOR VLSI CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

CAD for VLSI Circuits detailed syllabus for Electronics & Communication Engineering (ECE) for 2019 regulation curriculum has been taken from the Anna Universities official website and presented for the ECE students. For course code, course name, number of credits for a course and other scheme related information, do visit full semester subjects post given below.

Course Objectives:

This course enables students to

- Learn VLSI Design methodologies.
- Understand layout, placement and partitioning.
- Understand floor planning and routing along with algorithm.
- Learn different types of modelling techniques.
- Understand the concepts of high-level synthesis.

UNIT I INTRODUCTION TO VLSI DESIGN FLOW 9 hours

Introduction to VLSI Design methodologies, Basics of VLSI design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, General purpose methods for combinatorial optimization.

UNIT II LAYOUT, PLACEMENT AND PARTITIONING 9 hours

Layout Compaction, Design rules, Problem formulation, Algorithms for constraint graph compaction, Placement and partitioning, Circuit representation, Placement algorithms, Partitioning

UNIT III FLOOR PLANNING AND ROUTING 9 hours

Floor planning concepts, Shape functions and floorplan sizing, Types of local routing problems, Area routing, Channel routing, Global routing, Algorithms for global routing.

UNIT IV SIMULATION AND LOGIC SYNTHESIS 9 hours

Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation, Combinational Logic Synthesis, Binary Decision Diagrams, Two Level Logic Synthesis.

UNIT V HIGH LEVEL SYNTHESIS 9 hours

Hardware models for high level synthesis, internal representation, allocation, assignment and scheduling, scheduling algorithms, Assignment problem, High level transformations.

Course Outcomes:

After completing this Unit, students will be able to

- Outline floor planning and routing
- Exemplify the significance VLSI Design flow.
- Learn the entire process associated with layout, placement and partitioning.
- Learn the different algorithms associated with routing and concepts of floorplanning.
- Implement different modelling techniques.
- Discuss the hardware models for high level synthesis.

Text Book(s)

1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002

2. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.

Reference Books

1. Sadiq M. Sait, Habib Youssef, “VLSI Physical Design automation: Theory and Practice”, World Scientific 1999.
2. Steven M.Rubin, “Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE109 ASIC DESIGN

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

The different types of FPFAs, Programmable ASICs design has been covered in the course. The course gives the introduction to program the Xilinx and CPLD.

Course Objectives:

This course enables students to

1. Study the introduction to ASICs
2. Know the programming techniques of different memories.
3. Understand the programming of Xilinx.
4. Learn logic synthesis of ASIC circuits.
5. Know the floor planning and routing of ASICs circuits.

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN **9 hours**

Types of ASICs - Design flow, Standard-cell-based ASICs, Gate array-based ASICs, channelled gate array, channel less gate array, structured gate array, programmable logic devices, field programmable gate arrays, design flow. ASIC Cell Libraries. ASIC library design: transistors as resistors, transistor parasitic capacitance

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS **9 hours**

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT – Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN **9 hours**

SOFTWARE AND LOW-LEVEL DESIGN ENTRY Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 – Altera FLEX – Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language – PLA tools -EDIF- CFI design representation

UNIT IV SILICON ON CHIP DESIGN **9 hours**

Voice over IP SOC - Intellectual Property – SOC Design challenges- Methodology and design- FPGA to ASIC conversion – Design for integration-SOC verification-Set top box SOC.

UNIT V PHYSICAL AND LOW POWER DESIGN **9 hours**

Over view of physical design flow- tips and guideline for physical design- modern physical design techniques- power dissipation-low power design techniques and methodologies-low power design Tools- tips and guideline for low power design. TEST: The importance of test, boundary-scan test, faults, fault simulation, automatic test-pattern generation, scan test, built-in self-test, a simple test example.

Course Outcomes:

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

1. Describe the introduction to ASICs
2. Demonstrate programming techniques of different memories.
3. Designing of the programming of Xilinx.
4. Designing of logic sysnthesis of ASIC circuits.
5. Understand the floor planning and routing of ASICs circuits.

Text Book(s)

1. Michael John Sebastian Smith,Application-Specific Integrated Circuits, Pearson Education, 2001.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
3. Wayne Wolf, Modern VLSI Design, 4 th Ed., Pearson Education, 2002

Reference Books

1. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers,
2. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs).
3. J.Bhaskar, “ A VHDL Synthesis Primer” BS Publications , 2001.
4 Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis. Vol. 1. Prentice Hall Professional, 2003.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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Honors

20HDECE601 ADVANCED RF TRANSMISSION, RECEPTION, AND SIGNAL PROCESSING

L	T	P	C
1	0	2	2

Pre-requisite **20ECE112**

Course Description:

This course begins with an introduction to principles and components of RF systems such as Transmitters, Receivers, and Waveguides with various signal Modulation and Demodulation techniques. It delves into the advanced signal processing and DSP concepts such as Adaptive Filtering, Fourier and Wavelet Transform in RF and Spectral Estimation Techniques to RF systems. RF propagation mechanisms and path loss models, and appropriate signal processing techniques are analyzed. In the latter part of the course, the focus shifts to RF circuit design, emphasizing impedance matching, S-parameters, and the integration of DSP in RF systems triggers into RF system testing and measurement, exploring practical applications of signal processing in modern communication systems. Throughout the course, students will engage in MATLAB-based experiments, allowing them to model, simulate, and analyze RF components and systems, bridging theoretical knowledge with practical skills.

Course Objectives:

This course enables students to

1. Develop an understanding of RF transmission and reception principles, including the components of RF systems and signal modulation/demodulation techniques, through modeling and simulation using MATLAB.
2. Master the advanced concepts of signal processing and DSP, such as Adaptive Filtering, Fourier and Wavelet Transform in RF and Spectral Estimation Techniques, and integrate these with RF circuit design, demonstrated through MATLAB-based analysis and design.
3. Illustrate RF propagation mechanisms and path loss models provoking signal processing techniques with the simulation of RF propagation effects using MATLAB.
4. Learn RF circuit design principles, including impedance matching and S-parameters exploring integration of DSP with RF systems in MATLAB.
5. Apply signal processing techniques to RF testing equipment and methodologies with various measurements using MATLAB.

UNIT I Introduction to RF Transmission and Reception 6 hours

Introduction to RF principles - Basic components of RF systems: Transmitters, receivers and waveguides - Signal modulation and demodulation techniques.
Experiment 1: Modeling and Simulation of RF Transmitter and Receiver Components Using MATLAB.
Experiment 2: Signal Modulation and Demodulation Techniques for RF Systems in MATLAB.

UNIT II Advanced Signal Processing for RF Systems 6 hours

Advanced Sampling Techniques - Advanced DSP Concepts: Adaptive Filtering, Fourier and Wavelet Transform in RF and Spectral Estimation Techniques - Integration of DSP with RF Circuit Design.
Experiment 1: Advanced Sampling and Quantization Analysis Using MATLAB.
Experiment 2: Design and simulate advanced DSP algorithms such as adaptive filtering (LMS, RLS), spectral estimation, and digital beamforming for RF signal processing using MATLAB.

UNIT III RF Propagation and Signal Processing Techniques 6 hours

RF propagation mechanisms: Reflection, refraction, diffraction, and scattering - Path loss models: Free-space, ground reflection, and multi-path propagation - Signal processing for RF systems.
Experiment 1: Simulation and Analysis of RF Propagation Mechanisms Using MATLAB
Experiment 2: Modeling and Evaluation of Path Loss in Multi-Path RF Environments Using MATLAB

UNIT IV RF Circuit Design with Signal Processing 6 hours

Introduction to RF circuit components - Impedance matching and S-parameters - DSP in RF systems - RF system integration with signal processing.
Experiment 1: Design and Simulation of RF Circuit Components with Impedance Matching Using MATLAB
Experiment 2: Analysis of S-Parameters and DSP Integration in RF Systems Using MATLAB

UNIT V RF System Testing, Measurement and Signal Processing Applications 6 hours

Introduction to RF testing equipment - Signal processing in RF testing - RF systems in modern communication - Practical considerations in RF testing.
Experiment 1: Simulation of RF System Testing and Measurement Techniques Using MATLAB
Experiment 2: Application of Signal Processing in RF Testing for Modern Communication Systems Using MATLAB

Course Outcomes:

Upon the completion of the course, Students will be able to

1. Demonstrate RF system components and signal Modulation/Demodulation techniques with the concepts of modelling and simulation of RF Transmitters and Receivers using MATLAB.
2. Apply fundamental signal processing concepts to RF systems with various DSP algorithms using MATLAB.
3. Analyze and simulate RF propagation mechanisms with various Path loss models including Signal processing techniques to address RF propagation challenges using MATLAB.
4. Investigate RF circuits with a focus on Impedance Matching and S-parameters integrating DSP techniques using MATLAB.
5. Conduct RF system testing and measurement using advanced signal processing techniques focusing practical testing environment using MATLAB.

Text Book(s)

1. Reinhold Ludwig and Pavel Bretchko, “RF Circuit Design: Theory and Applications”, 1st Edition, Pearson Publishers, 2000.
2. Fawwaz T. Ulaby and Umberto Ravaioli, “Fundamentals of Applied Electromagnetics”, 7th Edition, Pearson Publishers, 2015.
3. John G. Proakis and Dimitris K. Manolakis, “Digital Signal Processing”, 4th Edition, Pearson Education India, 2007.
4. William J. Palm III, “Introduction to MATLAB for Engineers”, 3rd Edition, McGraw Hill, 2010.

Reference Books

1. Christopher Bowick, “RF Circuit Design”, 2nd Edition, Newnes Publishers, 2007.
2. Paolo Prandoni and Martin Vetterli, “Signal Processing for Communications”, 1st Edition, EPFL Press, 2008.
3. Agam Kumar Tyagi, “Matlab and Simulink for Engineers”, Oxford, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.