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 2018-19 Batches onwards

and
B. Tech. Lateral Entry Scheme from the academic year 2019-20

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

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRONICS AND COMMUNICATION ENGINEERING

Total Credits: 160 (4 Year Course)

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)
3	Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he /she is interested)	As specified by the Virtual Laboratory

II. Semester-wise Structure of Curriculum

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

I Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18ENG101	Professional English	2	0	2	4	3
2	Basic Science Course	18MAT101	Engineering Calculus	3	1	0	4	4
3	Basic Science Course	18CHE101	Engineering Chemistry	3	0	0	3	3
4	Engineering Science Course	18ME101	Engineering Graphics	2	0	3	5	3.5
5	Engineering Science Course	18CSE101	Programming for Problem Solving (Python)	2	0	2	4	3
6	Basic Science Course	18CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	Engineering Science Course	18ME201	Workshop Practice	0	0	3	3	1.5
			Total	**12**	**1**	**13**	**26**	**19.5**

I Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week L	Hours Per Week T	Hours Per Week P	Hours Per Week Total Contact Hours	Credits
1	Basic Science Course	18MAT107	Linear Algebra, Complex Variables and Ordinary Differential Equations	3	1	0	4	4
2	Basic Science Course	18PHY103	Physics: Electromagnetic Theory	3	1	0	4	4
3	Engineering Science Course	18EEE101	Basic Electrical Engineering	3	0	0	3	3
4	Engineering Science Course	18CSE102	C Programming and Data Structures	3	0	0	3	3
5	Basic Science Course	18PHY201	Physics Laboratory	0	0	3	3	1.5
6	Engineering Science Course	18EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
7	Engineering Science Course	18CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
			Total	**12**	**2**	**9**	**23**	**18.5**

II Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week L	T	P	Total Contact Hours	Credits
1	Humanities and Social Sciences including Management	18HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	Basic Science Course	18BIO101	Life Sciences for Engineers	3	0	0	3	3
3	Professional Core Course	18ECE101	Network Theory	3	0	0	3	3
4	Professional Core Course	18ECE102	Digital System Design	3	0	0	3	3
5	Professional Core Course	18ECE103	Electronic Devices and Circuits	3	1	0	4	4
6	Humanities and Social Sciences including Management	18ENG201	English Communication – Listening & Speaking Laboratory	0	0	3	3	1.5
7	Professional Core Course	18ECE201	Digital System Design Laboratory	0	0	3	3	1.5
8	Professional Core Course	18ECE202	Electronic Devices and Circuits Laboratory	0	0	3	3	1.5
9	Mandatory non-credit Course		Mandatory Course – I (Refer Annexure - V)	2	0	0	2	0
			Total	**17**	**1**	**9**	**27**	**20.5**

II Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities and Social Sciences including Management	18HUM102	Principles of Management	3	0	0	3	3
2	Basic Science Course	18MAT109	Probability and Stochastic Processes	3	0	0	3	3
3	Professional Core Course	18ECE104	Principles of Signals and Systems	2	1	0	3	3
4	Professional Core Course	18ECE105	Analog Circuits	3	0	0	3	3
5	Professional Core Course	18ECE106	Control System Engineering	2	1	0	3	3
6	Professional Core Course	18ECE107	Microprocessor and Microcontroller	3	0	0	3	3
7	Professional Core Course	18ECE203	Analog Circuits Laboratory	0	0	3	3	1.5
8	Professional Core Course	18ECE204	Simulation and Control Systems Laboratory	0	0	3	3	1.5
9	Professional Core Course	18ECE205	Microprocessor and Microcontroller Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – II (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**2**	**9**	**29**	**22.5**
Summer Internship								

III Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week L	T	P	Total Contact Hours	Credits
1	Humanities and Social Sciences including Management	18ENG102	English Communication - Reading and Writing	2	0	0	2	2
2	Engineering Science Course	18ECE108	AI Tools, Techniques and Applications	3	0	0	3	3
3	Professional Core Course	18ECE109	Analog and Digital Communications	3	0	0	3	3
4	Professional Core Course	18ECE110	Digital Signal Processing	2	1	0	3	3
5	Professional Elective Course		Discipline Elective – I (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – I (Refer Annexure - II)	3	0	0	3	3
7	Engineering Science Course	18ECE206	AI Tools, Techniques and Applications Laboratory	0	0	3	3	1.5
8	Professional Core Course	18ECE207	Analog and Digital Communications Laboratory	0	0	3	3	1.5
9	Professional Core Course	18ECE208	Digital Signal Processing Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – III (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**1**	**9**	**28**	**21.5**

III Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Engineering Science Course	18ECE111	Internet of Things	3	0	0	3	3
2	Professional Core Course	18ECE112	Electromagnetic Waves and Waveguides	2	1	0	3	3
3	Professional Core Course	18ECE113	VLSI Design	3	0	0	3	3
4	Professional Elective Course		Discipline Elective – II (Refer Annexure - III)	3	0	0	3	3
5	Professional Elective Course		Discipline Elective- III (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – II (Refer Annexure - II)	3	0	0	3	3
7	Social Sciences including Management	18ENG202	Corporate Communication Laboratory	0	0	2	2	1
8	Engineering Science Course	18ECE209	Internet of Things Laboratory	0	0	3	3	1.5
9	Professional Core Course		Virtual Laboratory (Refer Annexure - IV)	0	0	2	2	0
10	Mandatory non-credit Course		Mandatory Course – IV (Refer Annexure - V)	2	0	0	2	0
			Total	**19**	**1**	**7**	**27**	**20.5**
Summer Internship								

IV Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Core Course	18ECE114	Microwave Engineering	3	0	0	3	3
2	Engineering Science Course	18ECE115	Computer Communication Networks	3	0	0	3	3
3	Professional Elective Course		Discipline Elective- IV (Refer Annexure - III)	3	0	0	3	3
4	Professional Elective Course		Discipline Elective- V (Refer Annexure - III)	3	0	0	3	3
5	Open Elective Course		Open Elective – III (Refer Annexure - III)	3	0	0	3	3
6	Professional Core Course	18ECE210	Microwave Engineering Laboratory	0	0	2	2	1
7	Professional Core Course	18ECE211	Computer Communication Networks Laboratory	0	0	2	2	1
8	PROJ - ECE	18ECE701	Project Work – I	0	0	4	4	2
			Total	**15**	**0**	**8**	**23**	**19**

IV Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Elective Course		Discipline Elective – VI (Refer Annexure - III)	3	0	0	3	3
2	Open Elective Course		Open Elective- IV (Refer Annexure - II)	3	0	0	3	3
3	PROJ-ECE	18ECE702	Project Work - II	0	0	24	24	12
			Total	**6**	**0**	**24**	**30**	**18**

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

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)
Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	18ENG3M01/ 18ENG3M01C	Soft Skills	English & Training
2	18ENG3M02/ 18ENG3M02C	Developing Soft Skills and Personality	English & Training
3	18ENG3M03/ 18ENG3M03C	Soft Skill Development	English & Training
4	18HUM3M01/ 18HUM3M01C	Project Management for Managers	Humanities
5	18HUM3M02/ 18HUM3M02C	Ethics in Engineering Practice	Humanities
6	18CE3M01/ 18CE3M01C	Integrated Waste Management for Smart City	Civil
7	18CE3M02/ 18CE3M02C	Soil and Water Conservation Engineering	Civil
8	18CE3M03/ 18CE3M03C	Engineering Geology	Civil
9	18ME3M01/ 18ME3M01C	Six Sigma	Mechanical
10	18ME3M02/ 18ME3M02C	Operations Research	Mechanical
11	18ME3M03/ 18ME3M03C	Design Thinking and Innovation	Mechanical
12	18EEE3M01/ 18EEE3M01C	Non-Conventional Energy Sources	EEE
13	18EEE3M02/ 18EEE3M02C	Design of Photovoltaic Systems	EEE
14	18CSE3M01/ 18CSE3M01C	Social Networks	CSE
15	18CSE3M02/ 18CSE3M02C	Privacy and Security in Online Social Media	CSE

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

Dept. of Electronics and Communication Engineering

OPEN ELECTIVE – II (To be offered under Conventional Mode)			
S.No	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18MAT301	Advanced Numerical Methods	Mathematics
2	18MAT302	Engineering Optimization	Mathematics
3	18PHY301	Optical Physics and its Applications	Physics
4	18PHY302	LASER Physics and Advanced LASER Technology	Physics
5	18CHE301	Introduction to Petroleum Industry	Chemistry
6	18CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	18HUM301	Intellectual Property Rights	Humanities
8	18HUM302	Human Resource Development	Humanities
9	18HUM304	National Cadet Corps	Humanities
10	18CE301	Ground Improvement Techniques	Civil
11	18CE302	Environmental Impact Assessment	Civil
12	18CE303	Watershed Management	Civil
13	18ME301	Material Science for Engineers	Mechanical
14	18ME302	Elements of Mechanical Engineering	Mechanical
15	18ME303	Basic Thermodynamics	Mechanical
16	18EEE301	Industrial Electrical Systems	EEE
17	18EEE302	Introduction to MEMS	EEE
18	18CSE301	Operating Systems	CSE
18	18CSE302	E-Learning Technologies	CSE

OPEN ELECTIVE – III

(To be offered under MOOC's Category from SWAYAM – NPTEL)
Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL

S.No	Course Code	Course Title	Course Offered by Department of
1	18ENG3M04/ 18ENG3M04C	Speaking Effectively	English
2	18HUM3M03/ 18HUM3M03C	Management Information System	Humanities
3	18CE3M04/ 18CE3M04C	Remote Sensing and GIS	Civil
4	18CE3M05/ 18CE3M05C	Waste Water Treatment and Recycling	Civil
5	18ME3M04/ 18ME3M04C	Power Plant Engineering	Mechanical
6	18ME3M05/ 18ME3M05C	Mechatronics and Manufacturing Automation	Mechanical
7	18EEE3M03/ 18EEE3M03C	Introduction to Smart Grid	EEE
8	18CSE3M03/ 18CSE3M03C	Human Computer Interactions	CSE
9	18CSE3M04/ 18CSE3M04C	Programming in JAVA	CSE
10	18CSE3M05/ 18CSE3M05C	Multi-Core Computer Architecture – Storage and Interconnects	CSE
11	18IE3M01/ 18IE3M01C	Introduction to Research	General

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

OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
S.No	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18ENG301	Creative Writing	English
2	18HUM303	Entrepreneurship Development	Humanities
3	18MAT303	Graph Theory	Mathematics
4	18MAT304	Mathematical Modeling and Numerical Simulation	Mathematics
5	18PHY303	Thin Film Technology and its Applications	Physics
6	18CHE303	Introduction to Nano Science and Technology	Chemistry
7	18CHE304	Computational Methods in Materials Science and Engineering	Chemistry
8	18CE304	Green Building and Energy Conservation	Civil
9	18CE305	Environmental Engineering	Civil
10	18ME304	Internet of Manufacturing Things	Mechanical
11	18ME305	Entrepreneurship	Mechanical
12	18ME306	Total Quality Management	Mechanical
13	18EEE303	Robotics	EEE
14	18EEE304	Electrical Safety	EEE
15	18CSE304	Mobile Application Development	CSE
16	18CSE305	Software Project Management	CSE
17	18CSE306	Software Testing	CSE

ANNEXURE – III

List of Discipline Electives – ECE

Discipline Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE401	Nano Electronics
2.	18ECE402	Pattern Recognition and its Applications
3.	18ECE403	Bio-Medical Electronics
4.	18ECE404	Electronics Packaging and Testing
5.	18ECE405	Networks and Transmission Lines
Any advanced courses can be appended in future.		

Discipline Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL) Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE4M01/ 18ECE4M01C	Digital VLSI Testing
2.	18ECE4M02/ 18ECE4M02C	VLSI Physical Design
3.	18ECE4M03/ 18ECE4M03C	Semiconductor Opto-Electronics
4.	18ECE4M04/ 18ECE4M04C	Industrial Instrumentation
5.	18ECE4M05/ 18ECE4M05C	Computer Architecture
6.	18ECE4M06/ 18ECE4M06C	Computer Architecture and Organization
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Discipline Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE406	Fiber Optic Communication
2.	18ECE407	Embedded Systems
3.	18ECE408	Information Theory and Coding
4.	18ECE409	FPGA based System Design
5.	18ECE410	DSP Architectures
Any advanced courses can be appended in future.		

Discipline Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE411	Antennas and Propagation
2.	18ECE412	ASIC and FPGA Design
3.	18ECE413	Wireless Communication
4.	18ECE414	Software for Embedded Systems
5.	18ECE415	Speech and Audio Processing
Any advanced courses can be appended in future.		

Discipline Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE416	Digital Image and Video Processing
2.	18ECE417	Satellite Communication
3.	18ECE418	Error Correcting Codes
4.	18ECE419	Mobile Communication and Networks
5.	18ECE420	Optical Communication Networks
Any advanced courses can be appended in future.		

Discipline Elective – VI		
Sl. No.	**Course Code**	**Course Title**
1.	18ECE421	Wireless Sensor Networks
2.	18ECE422	Wavelets and its Applications
3.	18ECE423	Mixed Signal Design
4.	18ECE424	Cognitive Radio
5.	18ECE425	Adaptive Signal Processing
Any advanced courses can be appended in future.		

ANNEXURE –IV

ELECTRONICS AND COMMUNICATION ENGINEERING – VIRTUAL LABS

Sl. No.	Course Code	Course Title
1.	18ECE212	Virtual Electric Circuits Laboratory
2.	18ECE213	Transducers and Instrumentation Virtual Laboratory
3.	18ECE214	Electronic Design Laboratory (using DSP, FPGA, CPLD and Microcontrollers, through simulation and direct access of the hardware)

ANNEXURE – V

ELECTRONICS AND COMMUNICATION ENGINEERING – MANDATORY COURSES

Sl. No.	Course Code	Course Title
1	18CHE901	Environmental Sciences
2	18HUM902	Indian Constitution
3	18HUM903	Essence of Indian Traditional Knowledge
4	18CE904	Disaster Management

Annexure VI

Honors in Electronics & Communication Engineering

SI.No	Category	Course Code	Course Title	Hours Per Week L	Hours Per Week T	Hours Per Week P	Total Contact Hours	Credits
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	18HDECE101	Digital VLSI Design	3	0	0	3	3
2		18HDECE102	Advanced Digital System Design	3	0	0	3	3
3		18HDECE103	Real Time Operating Systems	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)**	18HDECE104	Advanced Digital Signal Processing	3	0	0	3	3
5		18HDECE105	Neural Networks and Fuzzy Logic	3	0	0	3	3
6		18HDECE106	Advanced Communication Networks	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	IV Year I Semester							
7	**Professional Elective Course (Choose any one from three courses)**	18HDECE107	System on Chip Design	3	0	0	3	3
8		18HDECE108	VLSI Signal Processing	3	0	0	3	3
9		18HDECE109	ASIC Design	3	0	0	3	3
10	**Project**	18HDECE701	Mini Project	0	0	10	10	5
	Sub Total			**3**	**0**	**10**	**13**	**8**
	Total			**15**	**0**	**10**	**25**	**20**

Annexure VII

Minors in Electronics & Communication Engineering
(Applicable to CE, EEE, ME, CSE, CST and CSIT)

Stream Name: Communication Systems (CS)

<table>
<tr><th rowspan="2">SI.No</th><th rowspan="2">Category</th><th rowspan="2">Course Code</th><th rowspan="2">Course Title</th><th colspan="4">Hours Per Week</th><th rowspan="2">Credits</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>Total Contact Hours</th></tr>
<tr><th colspan="9">III Year I Semester</th></tr>
<tr><td rowspan="2">1</td><td>Professional Core Course</td><td>18MDECE101</td><td>Electronics Engineering: Basic Principles and Applications (Except EEE Branch)</td><td rowspan="2">3</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">3</td><td rowspan="2">3</td></tr>
<tr><td>Professional Core Course</td><td>18MDECE102</td><td>Computer Communication Networks(for EEE Branch)</td></tr>
<tr><td>2</td><td>Professional Core Course</td><td>18MDECE103</td><td>Analog and Digital Communications</td><td>3</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><th colspan="9">III Year II Semester</th></tr>
<tr><td>3</td><td>Professional Core Course</td><td>18MDECE104</td><td>Satellite Communication</td><td>3</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>4</td><td>Professional Core Course</td><td>18MDECE105</td><td>Optical Communication</td><td>3</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>5</td><td>Professional Core Course</td><td>18MDECE201</td><td>Analog and Digital Communications Laboratory</td><td>0</td><td>0</td><td>4</td><td>4</td><td>2</td></tr>
<tr><th colspan="9">IV Year I Semester</th></tr>
<tr><td>6</td><td>Professional Core Course</td><td>18MDECE106</td><td>Mobile Telecommunication Networks</td><td>3</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>7</td><td>Professional Core Course</td><td>18MDECE701</td><td>Mini Project</td><td>0</td><td>0</td><td>6</td><td>6</td><td>3</td></tr>
<tr><td></td><td colspan="3" align="right">Total</td><td>15</td><td>0</td><td>10</td><td>25</td><td>20</td></tr>
</table>

Dept. of Electronics and Communication Engineering

Minors in Electronics & Communication Engineering

(Applicable to CE, EEE, ME, CSE, CST and CSIT)

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	18MDECE101	Electronics Engineering: Basic Principles and Applications (Except EEE Branch)	3	0	0	3	3
	Professional Core Course	18MDECE107	Computer Architecture (For EEE Branch)					
2	Professional Core Course	18MDECE108	Advanced Microprocessors	3	0	0	3	3
III Year II Semester								
3	Professional Core Course	18MDECE109	Microcontroller Programming with TI- MSP 430	3	0	0	3	3
4	Professional Core Course	18MDECE110	ARM – System on Chip Architecture	3	0	0	3	3
5	Professional Core Course	18MDECE202	Microprocessor and Microcontroller Laboratory	0	0	4	4	2
IV Year I Semester								
6	Professional Core Course	18MDECE111	Real Time Operating Systems	3	0	0	3	3
7	Professional Core Course	18MDECE701	Mini Project	0	0	6	6	3
			Total	**15**	**0**	**10**	**25**	**20**

B. Tech I Year I Semester

Dept. of Electronics and Communication Engineering

B. Tech I Year I Semester

18ENG101 PROFESSIONAL ENGLISH
(Common to all branches)

L	T	P	C
2	0	2	3

Course Prerequisite: 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;
Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.
(6)
Practical: Dumb Charade, Giving Direction, Talking about an experiment (Tenses), Running Commentary **(6)**

UNIT II: READING SKILLS & WRITTEN COMMUNICATION;
Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence. **(6)**
Practical: Short Passages – Reading Comprehension, Paragraph Writing, Skit Writing. **(6)**

UNIT III: VERBAL & NON-VERBAL ASPECTS;
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. **(6)**
Practical: Daily Activities, Role Play, JAM **(6)**

UNIT IV: CONVERSATIONS; Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend. **(6)**

Practical: Speaking: formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend, Character Portrayal.

Listening: Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures ,discussions from TV/Radio/Podcast. **(6)**

UNIT V: BUSINESS ENVIRONMENT & ETIQUETTES; sharing information of a personal kind - greeting & taking leave; Writing e-mails, memos, reports, etc. **(6)**

Practical: Mock Interview, Oral Presentation
(6)

Course Outcomes:
At the end of the course, learners 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.

Suggested Reading/Textbooks:

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:

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: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Electronics and Communication Engineering

B. Tech I Year I Semester

18MAT101 ENGINEERING CALCULUS

L	T	P	C
3	1	0	4

Course Prerequisite: Mathematics at Intermediate or Equivalent Level

Course Description

The course introduces the concepts of single variable and multivariable calculus with the view of its applications in various engineering fields. It prepares the students to develop various methods of finding derivatives and integrals; understanding of concepts related to continuous functions and enrich their experience in critical analysis.

Course Objectives

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

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. **(12)**

UNIT II: DIFFERENTIAL CALCULUS

Rolle's Theorem Mean value theorems, Taylor's and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima. **(12)**

UNIT III: SEQUENCE AND SERIES

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. **(12)**

UNIT IV: **MULTIVARIABLE DIFFERENTIAL CALCULUS**

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers. **(12)**

UNIT V: **MULTIVARIABLE INTEGRAL CALCULUS**
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, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs). **(12)**

Course Outcomes
At the end of the course, the students should 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, Internal Mid Examination, External End Examination.

Dept. of Electronics and Communication Engineering

B. Tech I Year I Semester

18CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Course 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

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) and its importance and Chlorides. Disadvantages (industry level) of using hard water. 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. **(9)**

UNIT II: PERIODIC PROPERTIES AND ORGANIC REACTIONS

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (S_N^1 and S_N^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism). **(9)**

UNIT III: SPECTROSCOPY

Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy. **(9)**

UNIT IV: THERMODYNAMICS AND ELECTROCHEMISTRY

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes and Free Energies. 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 and Solid Oxide). **(9)**

UNIT V: ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY

EngineeringMaterials: Cement Materials and Manufacturing Process. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Saponification Number, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Sol-Gel, Hydrothermal (Metal Oxide Nanoparticles) and Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials – Energy (Hydrogen Storage and Solar Energy) and Environmental Sciences-Photocatalytic Dye Degradation (TiO_2 and ZnO) **(9)**

Course Outcomes:

At the end of the course, the 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. Ralph H. Petrucci, F. Geoffrey Herring, Jeffry D. Madura, Carey Bissonnette, General Chemistry - Principles and Modern Applications, Tenth Edition, (Pearson, 2011).
4. Dr S. S. Dara and Dr S. S. Umare, A Text book of Engineering Chemistry,1st Edition.(S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1st 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.

Dept. of Electronics and Communication Engineering

B. Tech I Year I Semester

18ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	3	3.5

Course Prerequisite: 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
Introduction to AutoCAD commands, simple drawings, Orthographic Projections-Theory, techniques, first angle projections and third angle projections. **(15)**

UNIT II: PROJECTIONS OF POINTS & LINES
Projections of points: Positions, notation system and projections. Projections of lines: positions, terms used, different cases, traces of lines and finding true lengths, auxiliary projections. **(15)**

UNIT III: PROJECTIONS OF PLANES & SOLIDS
Projections of planes: positions, terms used, different cases and projections procedure
Projections of Solids: Projections of Regular Solids inclined to one planes. **(15)**

UNIT IV: SECTIONS AND DEVELOPMENTS OF SOLIDS
Section Planes and Sectional View of Right Regular Solids-Prism, cylinder. True shapes of the sections. Development of Surfaces of Right Regular Solids-Prism, Cylinder and their Sectional Parts. **(15)**

UNIT V: INTERSECTIONS & ISOMETRIC PROJECTIONS

Intersections of surfaces of solids: Intersection between: Line-plane, Plane-plane, line-solid, solid-solid. **Isometric Projections**: Theory of isometric drawing, construction of isometric projection from orthographic. **(15)**

Course Outcomes:

The students after completing the course will be able to:

1. Identify various commands in AutoCAD and their usage for engineering graphics
2. Draw the projections of points and straight lines with AutoCAD
3. Draw the projections of the planes and sections of solids.
4. Sketch the intersections of surfaces and developments of solids
5. Draw the conversion of the orthographic views to isometric views and vice versa.

Text Book:

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

References:

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.ss

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

B. Tech I Year I Semester

18CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	2	3

Course Prerequisite: 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:
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.

UNIT-I INTRODUCTION:
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?

(12)

UNIT-II:OPERATORS AND EXPRESSIONS:
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.

(12)

UNIT-III:DATA STRUCTURES

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. **(12)**

UNIT-IV: STRING HANDLING -MODULES:
Creating modules, import statement, from.import statement, name spacing-**Files and Directories**

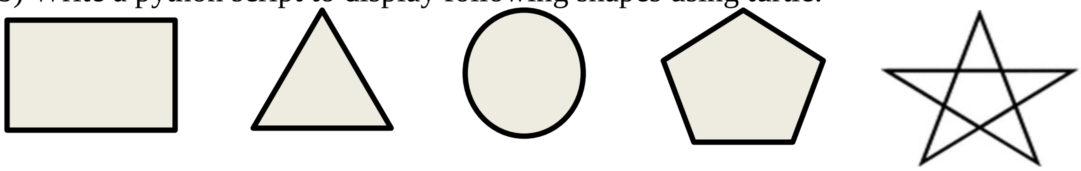
a) Implement Python program to perform various operations on string using string libraries.
b) Implement Python program to remove punctuations from a given string.
c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string 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

(12)

UNIT-V: PYTHON PACKAGES
Introduction to PIP, Installing Packages via PIP (Numpy, Pandas etc.., Using Python Packages.
Brief Tour of the Standard Library - Dates and Times, Data Compression, Turtle Graphics.

(10)

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



(12)

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 Book:
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/think-python/)
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

18CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: Basic Chemistry at Intermediate or equivalent level.

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

Course Objective:
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 highlighting the role of chemistry in engineering.
5. Learn and understand the practical implementation of fundamental concepts.

Lab Experiments (12 Experiments)

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Adsorption of acetic acid by charcoal.
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.

Text Book:

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 Text book 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

18ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Course Prerequisite: 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)

Add- on Course:

1. Components of Computer & Assembling a Computer: Learning about the different parts of the computer and its advancement

- Processor
- Memory – Types
- Motherboard
- Peripheral interfaces – I/O devices

- Learn about the proper connectivity among the devices inside the PC
- Assembling the different parts of the computer inside the cabinet

Course Outcomes

2. Install Operating System

- Partition the disk drive based on the capacity and the OS to be installed using utility tools
- Install Windows
- Install Linux or Ubuntu - use command line installation

3. Basic PC Troubleshooting

- Awareness on the possible issues in a computer
- Troubleshooting the problems using the available tools
- Removal and repair of existing software
- Identification of suitable Device driver for Hardware Devices.

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.

B. Tech I Year II Semester

B. Tech I Year II Semester

18MAT107 LINEAR ALGEBRA, COMPLEX VARIABLE AND ORDINARY DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

Course Prerequisite: 18MAT101

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 eigen-values and eigen-vectors.
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

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. **(12)**

UNIT II: COMPLEX VARIABLE - DIFFERENTIATION

Differentiation, Cauchy-Riemann equations, Analytic function, Harmonic functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm) and their properties. **(12)**

UNIT III: COMPLEX VARIABLE - INTEGRATION

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, Evaluation of certain improper integrals using the Bromwich contour. **(12)**

UNIT IV: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS
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. **(12)**

UNIT V: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS
Second order linear differential equations with variable coefficients, Method of variation of parameters, Laplace Transform, Inverse Laplace transform, Bromwich contour method, and its applications to solve ordinary differential equations. **(12)**

Course outcomes

Students are 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.

References:

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

18PHY103 PHYSICS: ELECTROMAGNETIC THEORY

L	T	P	C
3	1	0	4

Course Prerequisite: 18MAT101 and Intermediate Physics

Course Description: This course intends to provide the students to have a fair knowledge with an understanding about the theory and problems of static and dynamic electric and magnetic fields and their interaction and to enable them to use these concepts in applications. The course covers topics on vector algebra, Coulomb's law, Laplace's equation for electrostatic potential, conductors and capacitors, magnetic field due to a magnet, magnetic fields in matter, Maxwell's equations.

Course Objectives:

1. To understand the concepts of Vector calculus.
2. To understand the concepts of Electrostatics, Magnetostatics and their applications.
3. To estimate the Electric field intensity, potential and capacitance for different configurations and for different charge distributions.
4. To calculate the dipole moment, torque on dipole in the electric field and behaviour of conductors, insulators in electric field.
5. To analyse the Maxwell's equations, Neumann's formula.

UNIT I: MATHEMATICAL TECHNIQUES

Vector algebra, Gradient, divergence and curl, Line, surface and volume integrals, Curvilinear co-ordinates, Dirac Delta Function, Theory of Vector Fields. **(12)**

UNIT II: ELECTROSTATICS AND ELECTRIC POTENTIAL

Introduction, Coulomb's law, Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic fields; Laplace's and Poisson's equations for electrostatic potential; boundary conditions of electric field and electrostatic potential; Method of images; energy of a charge distribution and its expression in terms of electric field, multipole expansion. **(12)**

UNIT III: **ELECTRIC FIELDS IN MATTER**

Polarization; Electrostatic field and potential of a dipole; Bound charges due to electric polarization; electric displacement; boundary conditions on displacement; Linear dielectrics and dielectric constants. **(12)**

UNIT IV: **MAGNETO STATICS AND MAGNETIC FIELDS IN MATTER**
Lorentz force law; Biot-Savart law; Divergence and curl of static magnetic field; Ampere's law, Magnetic vector potential, Magnetization, the field of a magnetized object, Ampere's law in magnetized materials, Magnetic susceptibility and permeability. **(12)**

UNIT V: **ELECTRODYNAMICS**
Electromotive force; Ohm's law; Electromagnetic induction; Faraday's law; Energy in magnetic fields; Maxwell's equations, Boundary conditions, Wave equation. **(12)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand Gradient, Divergence and Curl along with fundamental Theorems.
2. Compute electric field intensity, displacement and potential for various charge distributions.
3. Apply Laplace equations to find potential distribution.
4. Solve magnetic field intensity for various current distributions.
5. Analyse time varying electromagnetic phenomena by using Maxwell's equations.

Text Books:
1. David J. Griffiths, "Introduction to Electrodynamics", Pearson Education Inc., Fourth Edition, 2012.
2. N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008.

References:
1. David Halliday, Robert Resnick and Kenneth S. Krane, Physics, Vol. 2, John Wiley & Sons, Inc., Fifth edition, 2002
2. W. Saslow, Electricity, magnetism and light, 2002.
3. John D. Krauss, "Electromagnetics", McGraw- Hill publications, 3rd ed., 1988.
4. 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. I Year II Semester

18EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: 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 circuits, 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 circuits 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
Electrical circuit elements (R, L and C), 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. **(9)**

UNIT II: AC CIRCUIT ANALYSIS
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. **(9)**

UNIT III: MAGNETIC MATERIALS AND TRANSFORMERS
Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency. **(9)**

UNIT IV: DC AND AC MACHINES
Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Generation of rotating magnetic fields, construction and working of a three-phase induction motor. Introduction of Single-phase induction motor. Introduction to Alternators. **(9)**

UNIT V: RECTIFIERS AND ELECTRICAL INSTALLATIONS
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, earthing. **(9)**

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 develop magnetic circuits to experiment and 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.

References:
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.

Dept. of Electronics and Communication Engineering

B. Tech. I Year II Semester

18CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisite: 18CSE101

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

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating stacks, queues, searching and sorting.

UNIT I: C PROGRAMMING
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). **(9)**

UNIT II: FUNCTIONS & ARRAY
Functions Introduction, User defined function, accessing a function, Function prototypes, Recursion, storage classes **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. **Searching:** Linear and Binary search **Sorting:** Bubble Sort and Insertion Sort. **(9)**

UNIT III: POINTERS AND STRUCTURE
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference. Dynamic memory allocation. **Structures:** Defining a structure, processing a structure. **(9)**

UNIT IV: STACK AND QUEUE
Classification of Data Structure, **Stack and Queues:** stack, stack operations, stack implementations using arrays.Queue, queue operations, queue implementations using array, types of queues, applications of stack and queue. **(9)**

UNIT V: STRINGS & FILES
Declaring and Defining a string, Initialization of strings, Strings Library functions **Files:** File Definition, Opening and closing a data file, Reading and Writing a data file, Files I/O Functions. **(9)**

Course Outcomes:

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

1. Understand problem solving techniques for a wide-range of problems.
2. Design and implement applications using functions, arrays, searching and sorting techniques.
3. Design and implement applications using pointers, structure and list.
4. Choose appropriate data structure depending on the problem to be solved.
5. Design and implement applications using Strings, Pointers and File processing.

Text Books:

1. The C Programming Language, Kernighan and Ritchie, 2 nd 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.

References:

1. Programming in ANSI C, E. Balagurusamy, Sixth Edition, Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education,5th edition, 20007.
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

18PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

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: (Any 10 Out of 18)
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. Ferroelectric hysteresis (B-H Curve). ***(ECE)***
8. Thickness of a given wire - Wedge Method.
9. Determination of Planck's constant. ***(EEE, CSE, CSIT, CST)***
10. Dispersive power of prism – Spectrometer.
11. Frequency of the tuning fork - Melde's apparatus.
12. Energy gap of a material of p-n junction. ***(EEE, CSE, CSIT, CST)***
13. Width of single slit - Diffraction due to Single Slit.
14. Measurement of e/m of electron (Helical Coil method) ***(ECE)***
15. Biot -Savart Law with Helmholtz Coil. ***(ECE)***
16. The Wheatstone Bridge. ***(ECE)***
17. Determination of particle size using Laser.
18. Torsional Pendulum. ***(ME & Civil)***

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, 4th Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th 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

18EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course 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 multimeters, 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, 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 cutout 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. 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 active power for star and delta connected balanced loads (single wattmeter method).
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

18CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: Computer Programming

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

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating linked lists, stacks, queues, searching and sorting.

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:

   Marks in Maths >=65
   Marks in Physics >=55
   Marks in Chemistry>=50
   OR
   Total in all three subject >=180

6. a) Write a C program to list all the factorial numbers less than or equal to an input number n.

   A number N is called a factorial number if it is the factorial of a Positive integer. For example, the first few factorial numbers are 1, 2, 6, 24, 120, ...
   Note - We do not list the factorial of 0.

   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

7. a) Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all the three points fall on one straight line.

   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.

8. a) Write a C program to find the series of prime numbers in the given range.

b) Write a C Program to Check Whether a Number is Palindrome or Not.

9. a) Write a c program to check whether a given number is a perfect number or not. (Perfect number is a positive number which sum of all positive divisors excluding that number is equal to that number. For example 6 is perfect number since divisor of 6 are 1, 2 and 3. Sum of its divisor is 1 + 2+ 3 = 6)

b) Write a C function to find the kth occurrence of an integer n in a sequence of non-negative integers, and then call your function from main.
Your function should be according to the following declaration:
int find(int n, int k);
sample example: input 3 2
1 1 3 2 3 -1
Output: 4

10. Write a C program to find Factorial, GCD, Fibonacci, (Using recursion)

11. 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

12. One needs to first input a set of N number of ALPHABETIC Strings each representing a name of a student in an array studname [N] . Assume each string can be Max. 40 Characters long. subsequently, one needs to input Marks obtained by those students in another array marks [N] Assume that studname [I] i.e. ith student in the list of student names has obtained Marks [I] in the Marks List. You need to find out and print the Max Marks obtained by a student and also print the name of the student who has obtained this mark.

13. Implement the following searching techniques

a) Linear Search b) Binary Search

10 .a) Bubble sort is a sorting algorithm that works by repeatedly stepping through lists that need to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. This passing procedure is repeated until no swaps are required, indicating that the list is sorted. Bubble sort gets its name because smaller elements bubble toward the top of the list. Consider an array of size 10. It will be filled it by reading 10 integers. The final output will be sorted output in Ascending Order.

b) Insertion sort is a sorting algorithm in which the elements are transferred one at a time to the right position. Here the first element in the array is considered as sorted, even if it is an unsorted array. Then each element in the array is checked with the previous elements, resulting in a growing sorted output list. With each iteration, the sorting algorithm removes one element at a time and finds the appropriate location within the sorted array and inserts it there. The iteration continues until the whole list is sorted. First an array of size 10 will be taken. We will fill it by reading 10 integers. The final output will be sorted output in Ascending Order.

11 a) Write a C program to swap two integers using pointers. You have to write a swap function that will accept the address of two integer and swap their values

b) Write a program in C to add two numbers using pointers. You have to write the fsum() function which accepts the address of two variables and returns the sum of their values to the main function.

12 Write a C program to compute internal marks of students for five different subjects using

Structures.

13 Implement the following Data Structures

a) Stack ADT b) queue ADT c) Circular queue ADT

14 a)Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using standard string library

functions.

b) Write a C program for reading a string and assigning its base address to the character pointer
to count characters are vowels or consonants.

15 a) Write a C program to copy the file contents from one file to another file (pass file names as

Command line arguments).
b) Write a C program to count no of lines, words and characters in a file.

Course Outcomes:
After completing this course the students should be able to
1. Understand problem solving techniques for a wide-range of problems.
2. Design and implement applications using functions and arrays.
3. Design and implement applications using Strings, Pointers and File processing.
4. Choose appropriate data structure depending on the problem to be solved.
5. Use appropriate searching and sorting technique to suit the application.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year I Semester

B. Tech. II Year I Semester

18HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: None

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 position of financial statements. Funds flows statements and cash flow statements are explained to know the analysis of financial matters.

Course Objectives: The course is intended to:

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 analysis through ratios, funds flow and cash flow statements.

UNIT I: DEMAND ANALYSIS:

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. **(9)**

UNIT II: PRODUCTION AND COST ANALYSIS

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). **(9)**

UNIT III: MARKET STRUCTURE:

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination and various market conditions. (9)

UNIT IV: BASICS OF ACCOUNTING:

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). **(9)**

UNIT V: BASICS OF FINANCIAL ANALYSIS

Ratio Analysis - Liquidity, Leverage, Solvency and Profitability Ratios - Interpretation of Financial Statements - FundS Flow Statement - Capital Budgeting **(9)**

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. Demonstrate the ability to apply knowledge of accounting concepts through Financial Statements Analysis.

Text Book:

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

References:

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

18BIO101 LIFE SCIENCES FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisites: Basic knowledge about sciences up to intermediate or equivalent level.

Course Description: The course deals with basic concepts of life sciences, its impact on human & universe, biological systems and functions, human physiology and metabolism.

Course Objectives

1. Introduce the molecular basis of life.
2. Provide the basis for classification of living organisms.
3. Describe the transfer of genetic information**.**
4. Introduce the techniques used for modification of living organisms**.**
5. Describe the applications of biomaterials

UNIT I: INTRODUCTION TO LIFE SCIENCES & LIVING ORGANISMS 8 hours

Why we need to study Life Sciences? Comparison and differences of biological organisms with manmade systems (Eye & Camera, Bird flying & Aircraft), Biological observations of 18th Century that led to major discoveries. Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources.

Learning Outcomes:
After completing this unit, the student will be able to

- **Summarize** the basis of life. (L2)
- **Distinguish** prokaryotes from eukaryotes. (L3)
- **Explain** the differences between biological organisms and manmade systems. (L2)
- **Classify** organisms. (L2)

UNIT II: BIO-MOLECULES & MACROMOLECULES 10 hours

Molecules of life: Water, Sugars, Starch, Cellulose, Amino acids, Structure and functions of proteins (primary, secondary, tertiary and quaternary structure), Structure and functions of nucleotides, nucleic acids, DNA (single and double strand) & RNA, hemoglobin, antibodies and enzymes, Industrial applications of enzymes and Fermentation process.

Learning Outcomes:
After completing this unit, the student will be able to

- **Outline** the importance of water. (L2)
- **Explain** the relationship between the structure and function of proteins. (L2)
- **Interpret** the relationship between the structure and function of nucleic acids. (L2)
- **Summarize** the applications of enzymes in industry. (L2)
- **Explain** the applications of fermentation in industry. (L2)

UNIT III: HUMAN PHYSIOLOGY **8 hours**

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, Neurons, Synaptic and Neuromuscular junctions.

Learning Outcomes:
After completing this unit, the student will be able to

- **Apply** thermodynamic principles to biological systems. (L3)
- **Explain** the mechanism of respiration and photosynthesis. (L2)
- **Summarize** the principles of information transfer and processing in humans. (L2)

UNIT IV: GENES, DNA & RNA **10 hours**

Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation. Discuss the concept of complementation using human genetics. Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Learning Outcomes:
After completing this unit, the student will be able to

- **Define** Mendel's laws. (L1)
- **Demonstrate** the mapping of genes. (L2)
- **Differentiate** mitosis and meiosis. (L3)
- **Explain** the medical importance of gene disorders. (L2)
- **Identify** DNA as a genetic material in the molecular basis of information transfer. (L2)

UNIT V: METABOLISM **9 hours**

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis).

Learning Outcomes:
After completing this unit, the student will be able to

- **Outline** the principles of recombinant DNA technology. (L2)
- **Identify** the potential of recombinant DNA technology. (L2)
- **Summarize** the use of biological materials for diagnostic devices. (L2)

Course Outcomes

After studying the course, the student will be able to:

- **Explain** catalytic properties of enzymes. (L2)
- **Summarize** application of enzymes and fermentation in industry. (L2)
- **Identify** DNA as a genetic material in the molecular basis of information transfer. (L2)
- **Apply** thermodynamic principles to biological systems. (L2)
- **Analyze** biological processes at the reductionistic level. (L4)
- **Identify** the potential of recombinant DNA technology. (L2)

Text books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A global approach”, Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.
3. Cell and Molecular Biology by De Robetis and De Robertis.

Reference Books:

1. Alberts Et.Al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012

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

B. Tech II Year I Semester

18ECE101 NETWORK THEORY

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

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:
1. To prepare students to analysis of any Continuous & Discrete, Fixed & Time varying, Linear & Nonlinear, Lumped & Distributed, Passive & Active networks and systems.
2. To empower students to understand the working of Network equations like Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem, Millman's theorem and its application in three phase unbalanced circuit analysis and Two port networks analysis.
3. To expose the students to the concepts of various types of Transient analysis of different electrical circuits with and without initial conditions using Laplace Transform and also Fourier series and Fourier Transform analysis of different types of waveform.
4. To analyze Graph theory and Networks equations and Filter Circuits.

UNIT I: NETWORK THEOREMS
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. **(12)**

UNIT II: RESONANCE
Definition of 'quality factor Q' of inductor and capacitor, Series resonance, Bandwidth of the series resonant circuits, Parallel resonance (or anti-resonance), Conditions for maximum impedance, Currents in parallel resonance, Impedance variation with frequency; universal resonance curves, Bandwidth of parallel resonant circuits, General case of parallel resonance circuit, Anti-resonance at all frequencies, variable phase angle circuit, reactance curves, Impedance Transformation. **(12)**

UNIT III: APPLICATION OF LAPLACE TRANSFORM TO ELECTRIC CIRCUITS
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. **(12)**

UNIT IV: TWO PORT NETWORK
Relationship of two port variables, Short circuit Admittance parameters, Open circuit Impedance parameters, Transmission Parameters, Hybrid Parameters, Relationship between parameter sets, Parallel connection of two port networks. **(12)**

UNIT V: FILTER DESIGN

Introduction, the Neper & decibel, Characteristic Impedance of symmetrical networks, the propagation constant, Properties of symmetrical networks, Filter fundamentals; pass and stop bands, Behavior of characteristic impedance, The constant – k low pass filter, the constant – k high pass filter, The m-derived T section, The *m*-derived π section, Variation of characteristic impedance over the pass band, Termination with *m* –derived half sections, Band-pass filters, Band elimination filters, Illustrative problems.

Course Outcomes:

On completion of the course students will be able to

1. Understand various theorems to solve the networks.
2. Describe 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 the filters.

Text Books

1. W H Hayt, J E Kemmerly and S M Durbin, "Engineering Circuit Analysis", Tata McGrawHill, 7th edition, 2010.
2. Sudhakar & Shyam Mohan S. Pillai "Circuits & Network Analysis & Synthesis", TataMcGraw Hill, 2nd Edition, 1994.
3. Van Valkenburg, "Network Analysis", PHI, 3rd Edition, 2011.

Reference Books

1. M.E.VanValkenburg,"Analog Filter Design",Holt Saunders International Editors.
2. Franklin F. Kuo, "Network Analysis and synthesis", Wiley India Pvt Ltd, 2nd Edition.
3. Chakrabarti, Dhanpat Rai & Sons, Circuit Theory (Analysis & Synthesis), 2010.
4. K.Chenna Venkatesh, D.Ganesh Rao, "Network Analysis- A Simplified Approach", Elsevier, 2nd Edition 2010.
5. John D. Ryder, "Networks, Lines, and Fields," PHI publications, Second Edition, 2012.
6. Mac Van Valkenburg, "Introduction to Modern Network Synthesis" Holt Saunders International Editors.

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

B. Tech II Year I Semester

18ECE102 DIGITAL SYSTEM DESIGN

	L	T	P	C
Course Prerequisite: 18EEE101	3	0	0	3

Course Description:
This course provides the fundamentals aspects of designing digital logic circuits, which includes combinational and sequential circuit design. It incorporates Boolean algebra, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives
1. To prepare students to perform the analysis and design of various digital electronic circuits.
2. To acquire the basic knowledge of Boolean algebra, logic simplification techniques (K-Map) and code conversion etc.
3. To understand the design of combinational and sequential logic circuits.
4. To learn logic families, semiconductor memories, and Programmable logic devices.
5. To understand the VLSI Design flow and learn the IEEE Standard 1076 Hardware Description Language (VHDL).

UNIT I: LOGIC SIMPLICATION
Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan'sTheorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion. **(9)**

UNIT II: COMBINATIONAL LOGIC DESIGN
MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half andFull Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU. **(9)**

UNIT III: SEQUENTIAL LOGIC DESIGN
Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation. **(9)**

UNIT IV: LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES
Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Conceptof Programmable logic devices like FPGA. Logic implementation using Programmable Devices. **(9)**

UNIT V: VLSI DESIGN FLOW
VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow VHDL constructs and codes for combinational and sequential circuits, Behavioral and Structural Modeling, Synthesis and Simulation. **(9)**

Course Outcomes

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

1. Develop a thorough understanding of the fundamental concepts and techniques used in digital electronics.
2. Understand and examine Boolean algebra, logic simplification techniques like K-Map and code conversion.
3. Design various combinational and sequential circuits.
4. Understand the concepts of TTL and CMOS digital logic families, concept of programmable logic devices and logical implementation of digital circuits using them.
5. Conceptualise VLSI Design Flow and apply the knowledge of VHDL to simulate and synthesize combinational and sequential logic circuits.

Text Books

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition, 2006.

Reference Books

1. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989.
2. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.
3. M. Morris Mano, Michael D. Ciletti, “Digital Design” Pearson Education Limited, 2013.

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

Dept. of Electronics and Communication Engineering

B. Tech II Year I Semester

18ECE103 ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	1	0	4

Course Prerequisite: 18EEE101

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) & Ebers Moll model, MOS Transistors and their characteristics.

Course Objectives

1. Understand the introduction to Semiconductor Physics.
2. Understand the fundamentals of operation of the semiconductor devices.
3. Understand the fundamentals of operation of electronic circuits.
4. Understand the applications of semiconductor devices.
5. Understand the low and high frequency response of transistor amplifiers

UNIT I: SEMICONDUCTOR DEVICES AND CHARACTERISTICS
Introduction to Semiconductor Physics: Energy bands in semiconductor, E-k diagrams, Direct and Indirect band-gap semiconductors, carrier concentration in semiconductor, Drift and Diffusion current, Hall effect, mobility and resistivity, Generation and recombination of carriers; P-N junction Diode: formation of P-N junction, working of diode, I-V characteristics, and small signal switching models. Avalanche breakdown, Operation and Characteristics of Zener diode, Schottky diode, Tunnel diodes, Varactor diode, PIN diode. **(9)**

UNIT II: TRANSISTORS
BJT- Structure, operation, characteristics and biasing, bias compensation techniques –Ebers-Moll Model, JFET- Structure, operation, characteristics and biasing - MOSFET- Structure, operation, MOS capacitor, characteristics and biasing – Types of MOSFET. **(9)**

UNIT III: APPLICATIONS OF DIODES AND TRANSISTORS
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. **(9)**

UNIT IV: LOW FREQUENCY ANALYSIS OF TRANSISTOR AMPLIFIERS
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 **(9)**

UNIT V: HIGH FREQUENCY ANALYSIS OF TRANSISTOR AMPLIFIERS
High frequency models of BJT, frequency response of CE amplifier, cascade amplifier, multistage amplifiers and its frequency response, MOSFET high frequency model and internal capacitance, frequency response of CS amplifier. **(9)**

Course Outcomes

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

1. Understand the operation of semiconductor PN junction devices.
2. Understand the semiconductor Transistor devices.
3. Understand the fundamentals of operation of electronic circuits.
4. Understand and utilize the mathematical models and characteristics of semiconductor junctions and MOS transistors for circuits and systems.
5. Understand the low and high frequency response of transistor amplifiers

Text Books

1. Adel S Sedra, Kenneth C Smith and Arun N Chandorkar, "Microelectronic Circuits – Theory and Applications", Seventh Edition, Oxford University Press, 2017.
2. Robert L Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Eleventh Edition, Pearson India Education Services Pvt. Ltd., 2015.

Reference Books

1. Donald A Neamen, "Electronic Circuits – Analysis and Design", Third Edition, McGraw Hill Education, 2006.
2. Albert Malvino and David Bates, Electronic Principles, Eighth Edition, McGraw Hill Education, 2016.

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

B. Tech II Year I Semester

18ENG201 ENGLISH COMMUNICATION – LISTENING & SPEAKING LABORATORY

(Common to all branches)

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18ENG101

Course Description: As the **s**tudents are being exposed to the global language 'English; it has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regard to two particular skills, i.e. Listening and Speaking. This course is offered in order to help students cultivate and nurture a mind that "thinks in English." Intricate issues of pronunciation, modulation, timbre are dealt with in regard to Speaking and also the sub-skills of Listening, thus the whole course is entirely lab oriented.

Course Objectives:

This course enables students to –

1. Hone in on their listening skills
2. Grasp the differences between native level and mother-tongue influenced pronunciation
3. Develop crucial speaking skills
4. Enhance vocabulary for greater communicative impact
5. Overall development of thinking in the English language

UNIT 1: Listening; Understanding key vocabulary; Listening for main ideas; Listening in detail; Syllable stress; Sentence stress; Presentation. **(12)**

UNIT 2: Vocabulary for important places (bank, library, restaurant, etc.); Prepositions for places; Stress determiners (this & that); Intonation. **(12)**

UNIT 3: Using background knowledge; Collocations; Pronouncing clusters of consonants (e.g. –gh, -ing, ph, ck); Mapping ideas; Pronunciation of phrases; Listening for opinion; Vocabulary and collocations for jobs. **(12)**

UNIT 4: Listening for lecture organization; Text organization features; Phrases with make; Evaluating and proposing ideas; Expressing attitudes. **(12)**

UNIT 5: Identifying opposing viewpoints; Silent letters; Idioms; Fixed expressions; Phrasal verbs. **(12)**

Dept. of Electronics and Communication Engineering

<u>Course Outcomes</u>: At the end of the course, learners will be able to:

1. Listening with intent
2. Pronounce more fluently
3. Develop crucial thinking skills
4. Enhance vocabulary
5. Overall development in the English language

Suggested Reading/Textbook:

1. Sabina Ostrowska; *Unlock 3 series(B1): Listening & Speaking*; Published by: Cambridge University Press.

Reference:

1. Gary Buck; *Assessing Listening;* Cambridge University Press, 2010.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Upper Intermediate (B2+)*; Published by: Cambridge University Press.
3. Josh Sreedharan; *The Four Skills for Communication;* Cambridge 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. Miles Carven; *Listening Extra*; Cambridge University Press, 2008.
7. Jayashree Mohanraj; *Speak Well*; Orient Blackswan, 2013.
8. F. Kipple; *Keep Talking*; Cambridge University Press, 2013.
9. *www.cambridgeenglish.org/in/*
10. https://learnenglish.britishcouncil.org/en/english-grammar
11. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electronics and Communication Engineering

B. Tech II Year I Semester

18ECE201 DIGITAL SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
This course is designed to help the students understand the basics of digital system design and its implementation in Programmable logic devices using VHDL (VHSIC Hardware Description Language).

Course Objectives
1. Consolidation of design methodologies for designing combinational and sequential circuits.
2. Knowledge and use of VHDL for system modeling and simulation.
3. Implementation of digital systems on reconfigurable programmable logic devices (CPLDs and FPGAs) .
4. Experience the acquisition of complete FPGA design flow on Computer Design Automation (CAD) tools.
5. To conduct combinational circuit design experiments using VHDL.
6. To conduct sequential circuit design experiments using VHDL.

LIST OF EXPERIMENTS
a. **1**. Familiarization of bench equipment's
1. Implementation of Boolean functions using logic gates (Hardware and Verilog)- logic gates 74xx.
2. Design of Adders and Subtractors using 74 xx ICs
3. **4**. Design of 3-8 decoder-74138 & 8-3 encoder-74x148
4. **5**. Design of 8x1 Multiplexers-74x151 and 2x4 demultiplexers-74x155
5. **6**. Design of Latches & Flip-flops: D-flipflop 74x74, jk flipflop 74x109
6. **7.** Design of 4-bit comparators 74x85
7. **8**. Design of Decade counters-74x90 and Universal Shift Registers 74x194
8. **9**. Design and implementation of following combinational logic circuits on FPGAs using VHDL:

(a) half adder
(b) half subtractor
(c) full adder
(d) full subtractor
(e) decoder
(f) encoder
(g) magnitude comparator

9. Design and implementation of following sequential logic circuits on FPGAs using VHDL:

(a) D latch
(b) D Flip flop
(c) T Flip Flop
(d) JK Flip flop
(e) Serial in Serial out Shift Register
(f) Asynchronous Counter
(e) Synchronous Counter

Project Based Learning:
1. Design of ALU Systems

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 implement combinational circuits using VHDL on EDA tool, Xilinx ISE.
4. Design and implement sequential circuits using VHDL on EDA tool, Xilinx ISE.
5. Interpret the specifications of programmable logic devices and select the appropriate for the applications at hand.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year I Semester

18ECE202 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
This course is designed to help the students to understand the characteristics of semiconductor devices like p-n junctions, Zener diodes, BJTs and JFETs.

Course Objectives
The purpose of this course is to provide knowledge of the following things:

1. To understand the I-V characteristics of p-n junction, Zener diode & JFET
2. To learn the applications of p-n junction diode and Zener diode
3. To understand frequency response of CE and CC amplifiers
4. To simulate and understand various network theorems for DC circuits
5. To simulate the I-V characteristics and frequency response of various configurations of amplifier circuits

LIST OF EXPERIMENTS

1. Forward and reverse bias I-V characteristics of p-n junction diode
2. Zener diode I-V characteristics. Zener as a voltage regulator.
3. JFET/MOSFET characteristics
4. Input and output characteristics of BJT in CB, CE, CC configuration.
5. Half and full wave rectifiers with and without RC filter.
6. Clipper and clamper circuits design and analysis.
7. Frequency response of CE and CC amplifier.
8. Simulation of nodal analysis for DC Circuits
9. Simulation of transient and parametric analysis of series RLC circuits using step, pulse and sine inputs
10. Simulation of Thevenin’s and Norton’s theorems for DC circuits
11. Simulation of maximum power transfer theorem for DC circuits
12. Simulation of reciprocity and superposition theorem for DC circuits
13. Simulation of input and output characteristics of transistor in CB, CE and CC configuration
14. Simulation of frequency response of CE and CC amplifiers.

Project Based Learning:

1. Design 9V and 12V power supply systems.

Course Outcomes:
Upon successful completion of this course, students will be able to learn the following things:

1. Analyze the characteristics of electronic devices such as p-n junctions, Zener diodes, BJT and JFETs.
2. Analyze and design simple circuits like half-wave, full-wave rectifiers, clipper and clamping circuits.
3. Analyze the frequency response of CE and CC amplifiers
4. Design and analyze DC circuits using various network theorems
5. Design and analyze various configurations of BJT amplifier circuits

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year II Semester

B. Tech II Year II Semester

18HUM102 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: None

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 about controlling, managing operations and functional areas of marketing and financial management.

UNIT I: INTRODUCTION

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. **(9)**

UNIT II: PLANNING

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. **(9)**

UNIT III: ORGANIZING

Organizational structures - HRM process, Contemporary issues in HRM – Departmentation – decentralization – delegation of Authority - Managing Change and Innovations. **(9)**

UNIT IV: COMMUNICATION, MOTIVATION AND LEADING

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. **(9)**

UNIT V: CONTROLLING

Process of control – Types of Control - feed-forward, concurrent and feedback controls, contemporary issues in control – Strategic role of Operations Management - Value Chain Management. **(9)**

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 and apply to achieve the corporate objectives.

Text Book:

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10th edition.

References:

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.

B. Tech. II Year II Semester

18MAT109 PROBABILITY AND STOCHASTIC PROCESSES

L	T	P	C
3	0	0	3

Course prerequisite: 18MAT101, 18MAT106.

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.

Objectives of the course:

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 1: PROBABILITY AND RANDOM VARIABLES

Probability introduced through sets and relative frequency, joint and conditional probability, independent events, combined experiments and Bernoulli trials. **(9)**

UNIT 2: ONE DIMENSIONAL RANDOM VARIABLE

Random variable concept, distribution function, density function, Gaussian, binomial, Poisson, uniform, exponential and Rayleigh distributions. Expected value of a random variable, moments, Chebychev's inequality, characteristic function, moment generating function and Chernoff's bounds. **(9)**

UNIT 3: MULTIPLE RANDOM VARIABLES

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. **(9)**

UNIT 4: TRANSFORMATION OF RANDOM VARIABLES AND RANDOM SEQUENCES

Jointly Gaussian random variables. Transformation of one and multiple random variables. 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. **(9)**

UNIT 5: RANDOM PROCESSES

Random process, stationarity and independence, correlation functions, measurement ofcorrelation functions, Gaussian random processes. Power spectrum density and its properties. Linear system fundamentals and random signal response of linear systems. **(9)**

Text Book:

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

Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," 3^{rd} edition, Pearson Education.
2. A. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," 4^{th} edition, McGraw-Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Course outcomes:

At the end of the course, the students should 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.

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

Dept. of Electronics and Communication Engineering

B. Tech II Year II Semester

18ECE104 PRINCIPLES OF SIGNALS AND SYSTEMS

L	T	P	C
2	1	0	3

Course Prerequisite: 18MAT101

Course Description

Signals and systems as seen in everyday life, and in various branches of engineering and science. This course provides a good understanding about signals, systems and their classification. 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.

Course Objectives

1. To study the properties and representation of discrete and continuous signals and systems
2. To study the sampling process and analysis of discrete systems using z-transforms.
3. To study the analysis and synthesis of discrete time systems.

UNIT I: INTRODUCTION TO SIGNALS AND SYSTEMS

Signals – Continuous-time (CT) & Discrete-Time (DT) signals - Signal Operations - Energy and power signals - Representation of signals in terms of impulse function – Classification of CT & DT Signals – Systems – Classifications &Properties of CT & DT systems – Introduction to computation tool of signal processing. **(9)**

UNIT II: LINEAR TIME INVARIANT (LTI) SYSTEMS

Discrete time LTI systems: Convolution Sum – Continuous time LTI systems: Convolution Integral – Properties of LTI systems – causality and stability of linear Time-invariant systems - Unit step response and unit impulse response of LTI systems – LTI systems represented by Linear Constant Coefficient differential and difference equations - Periodic and semi-periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response. **(9)**

UNIT III: FOURIER ANALYSIS

Fourier series representation, Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Representation of CT periodic signals by Continuous Time Fourier Series (CTFS) - Properties of CTFT - The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT) - Properties of DTFT. Parseval's Theorem. The idea of signal space and orthogonal bases. **(9)**

UNIT IV: LAPLACE AND Z TRANSFORMS

The Laplace Transform, notion of Eigen functions of LTI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems- Eigen functions, region of convergence, z-domain analysis. **(9)**

UNIT V: SAMPLING

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. - Effects of under sampling - Aliasing and its effects. Relation between continuous and discrete time systems. **(9)**

Course Outcomes

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

1. Recognize the fundamentals of signals and systems and analyze different types of signals& Systems.
2. Recall the information about LTI continuous time systems & illustrate the input output relationship of linear time invariant CT systems.
3. Represent continuous and discrete systems in time and frequency domain using Fourier transforms.
4. Analysis the stability and system behavior using the Laplace and Z Transform.
5. 5. Understand the Nyquist criteria in sampling and reconstruction of a signal.

Text Books

1. Alan V Oppenheim, Alan S Willsky and S Hamid Nawab ―Signals and Systems, second edition, PHI Learning Private Limited, New Delhi, 2010.
2. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.

Reference Books

1. Haykin. S and Barry Van Veen, ―Signals and Systems, John Wiley and Sons, Second Edition, 2012.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Hsu.H.P, RakeshRanjan, ―Signals and Systems, Schaums‘s Outlines, Tata McGraw Hill, Second Edition, 2010.
4. Samir S. Soliman, MandyamDhatiSrinath, ―Continuous and Discrete Signals and Systems, Second Edition, Prentice-Hall International, 2011.
5. Luis F. Chaparro, ―Signals and Systems Using MATLAB 1st Edition, Academic Press, An Imprint of Elsevier, 2011.

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

Dept. of Electronics and Communication Engineering

B. Tech II Year II Semester

18ECE105 ANALOG CIRCUITS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description

This course provides the basic knowledge on applications of diodes, biasing circuits for transistor circuits, designing amplifier circuits, oscillator and multi-vibrator circuits, operational amplifiers and applications, sample and hold circuits.

Course Objectives

1. To acquire the basic knowledge on feedback amplifiers and oscillators circuits.
2. To design and construct various classes of power amplifiers and tuned amplifiers.
3. To analyze the operational amplifier circuits as integrators and differentiators.
4. To understand the applications of operational amplifiers.
5. To learn and analyse special IC's and Data Converters.

UNIT I: FEEDBACK AMPLIFIERS AND OSCILLATORS

Feedback amplifiers: feedback topologies, voltage series, current series, voltage shunt, current shunt, effect of feedback on stability, gain, bandwidth, noise and distortion. Oscillators, Barkhausen criterion, RC oscillators: phase shift and Wien bridge oscillators, LC Oscillators: Hartley and Colpitts oscillators **(9)**

UNIT II: POWER AMPLIFIERS AND TUNED AMPLIFIERS

Power amplifiers: Class A, Class B, Class AB and Class C, estimation of power efficiency.
Tuned amplifiers: Single Tuned amplifier, Double Tuned amplifier, Stagger Tuned amplifier – Q factor – Stability – applications **(9)**

UNIT III: OPERATIONAL AMPLIFIERS

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. **(9)**

UNIT IV: APPLICATIONS OF OPERATIONAL AMPLIFIER

Nonlinear Op-amp circuits: Log and antilog Amplifiers, Analog switch - Sample and Hold circuit - Analog multipliers, Precision rectifiers, - Comparators and Schmitt Trigger - Active filters **(9)**

UNIT IV: SPECIAL IC'S AND DATA CONVERTERS

IC voltage regulators – 555 Timer – operation – Astable and Monostable modes and their applications – VCO – PLL – D/A converters – weighted resistor and R/2R ladder type converters - A / D converters – Flash type converters - Successive approximation converter. **(9)**

Course Outcomes

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

1. Develop analytical capability to analyze feedback in amplifiers.
2. Design various classes of power amplifiers and feedback amplifiers.
3. Analyze the operational amplifier circuits as integrators and differentiators.
4. Understand and analyze the applications of operational amplifiers, and sample and hold circuits.
5. Develop analytical capability to analyze special IC's and Data Converters.

Text Books:

1. A.S. Sedra and K.C. Smith, "Micro Electronic Circuits", Sixth Edition, Oxford University Press, 2011.
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education, 2008.
3. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008.

Reference Books:

1. Millman and Halkias, "Integrated Electronics", TMH, 2007.
2. D.Roy Choudhry and Shail B. Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
3. Alexander, Charles K., and Matthew NO Sadiku. Fundamentals of electric circuits. McGraw-Hill Education, 2000.
4. Johns, David A., and Ken Martin. Analog integrated circuit design. John Wiley & Sons, 2008.
5. Gray, Paul R., et al. Analysis and design of analog integrated circuits. John Wiley & Sons, 2009.

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

B. Tech II Year II Semester

18ECE106 CONTROL SYSTEM ENGINEERING

L	T	P	C
2	1	0	3

Course Prerequisite: 18ECE101, 18ECE104

Course Description

This course provides basic understanding of modeling and analysis of control systems, which further leads to compensator/controller design as per the system performance requirements. It covers the concept of system modeling 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

1. To recognize the importance, evolution and scope of control systems engineering, including challenges and possible remedies.
2. To gain the knowledge of basics of physical systems and processes, which can be utilized for their mathematical modeling, analysis and control.
3. To be aware of standard test signals, transient and steady-state response, error constants and key performance specifications in time and frequency domain.
4. To understand various control system stability analysis and design approaches.
5. To get acquainted with the practical aspects of control systems using software simulations and experimentations
6. To develop a basic foundation in modern control theory.

UNIT I: CONTROL SYSTEMS - MODELLING AND REPRESENTATION

A brief on history, evolution and scope of control systems, Practical control examples, System and its classification, Mathematical modeling of physical systems, Representation of linear systems using differential equations and transfer functions. Block diagram and its reduction rules, Signal flow graph and Masson's gain formula. **(9)**

UNIT II: TIME DOMAIN ANALYSIS

Transient and steady state response of feedback control systems, Time domain specifications, Location of poles on s-plane and the transient response, Steady-state errors and error constants. Introduction to P, PI and PID control actions, PID tuning and implementation using passive network, Performance indices (IAE and ISE), Simulation practices using MATLAB. **(9)**

UNIT III: STABILITY ANALYSIS AND CONTROLLER DESIGN

Concept of system stability, Routh-Hurwitz stability criterion, Relative stability, Concept of root locus and its procedure. Introduction to compensation technique, Lead-lag compensator design using root locus, Simulation practices using MATLAB. **(9)**

UNIT IV: FREQUENCY DOMAIN ANALYSIS

Bode plot, Frequency-domain specifications, Correlation between time and frequency domain specifications, Concept of stability and relative stability, Polar plots, Nyquist plots, Nyquist stability criterion. Lead-lag compensator design in frequency domain, Simulation practices using MATLAB. **(9)**

UNIT V: MODERN CONTROL THEORY
Introduction to state variables and state space models of linear systems, State transition matrix, Solution of state equations, Controllability & Observability, Simulation practices using MATLAB. **(9)**

Course Outcomes
Upon successful completion of the course, students will be able to
1. Utilize the knowledge of basic sciences to represent a variety of physical systems using mathematical and graphical models.
2. Describe the system behavior in terms of various performance parameters and apply controller design methodologies to study and improve the dynamic behavior of the system.
3. Identify the control objectives/problem for a given system/process using time and frequency domain specifications and investigate the stability and relative stability.
4. Analyze and implement control systems using simulation software and passive network.
5. Explain the benefits and concepts of modern control systems.

Text Books
1. Richard C. Dorf & Robert H. Bishop, "Modern Control Systems", Prentice Hall, 12th Edition, 2011.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition, 2010.

Reference Books
1. B.C. Kuo& F. Golnaraghi "Automatic Control System", John Wiley and Son's, 9th Edition, 2010.
2. I.J. Nagrath& M. Gopal, "Control System Engineering", New Age International Pvt. Ltd., 6th Edition, 2017.

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

B. Tech II Year II Semester

18ECE107 MICROPROCESSOR AND MICROCONTROLLER

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE102

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 different features of 8051 microcontroller, which includes instruction sets, addressing modes, serial port, interrupt programming and interfacing.

Course Objectives
1. To understand the 8086 architecture, addressing modes, instruction set
2. To analyse 8086 microprocessor interrupts and memory interfacing
3. To analyse 8086 microprocessor interfacing with various peripherals.
4. To understand 8051 microcontroller architecture, instruction set and addressing
5. To analyze interfacing of 8051 microcontroller with timers, serial port, interrupt and stepper motor.

UNIT I: 8086 MICROPROCESSOR
The 8086 Microprocessor: Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation. **(9)**

UNIT II: 8086 INTERRUPTS
Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation, Memory Interfacing, Co-processor, Introduction to advanced processors. **(9)**

UNIT III: I/O INTERFACING WITH 8086
I/O Interfacing: Parallel communication interface, D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: LED display, Keyboard display interface. **(9)**

UNIT IV: 8051 MICROCONTROLLER
Microcontroller: Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming. **(9)**

UNIT V: I/O INTERFACING WITH 8051
Interfacing Microcontroller: Programming 8051 Timers – Serial Port Programming – Interrupts Programming - Stepper Motor and Waveform generation, Introduction to PIC Microcontroller.**(9)**

Course Outcomes

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

1. Understand the 8086 architecture, addressing modes, instruction set and develop assembly language programming
2. Analyse 8086 microprocessor interrupts and memory interfacing
3. Analyse 8086 microprocessor interfacing with various peripherals.
4. Understand 8051 microcontroller architecture, instruction set and addressing modes and develop assembly language programming
5. Analyze interfacing of 8051 microcontroller with timers, serial port, interrupt and stepper motor.

Text Books

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson Education, 2011.

Reference Books

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Kenneth J. Ayala, "The 8086 Microprocessor- Programming & Interfacing The PC", India Edition, Cenage Learning, 2007.
3. Muhammad Ali Mazidi, Janice G. Mazidi, Rolin D. McKinlay , "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC 18", Pearson Education, 2008.

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

Dept. of Electronics and Communication Engineering

B. Tech II Year II Semester

18ECE203 ANALOG CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description

This course provides the basic knowledge to students to design and test oscillator and multivibrator circuits, operational amplifiers circuits, ADCs and DACs circuits.

Course Objectives

1. To design basic configuration of Op-Amp.
2. To design Multivibrator circuit.
3. To design Active filters.
4. To design various types of oscillator circuits and differential amplifier.
5. To design and test operational amplifiers-based circuits and DACs and ADCs.

LIST OF EXPERIMENTS

a. 1. Basic Configuration of Op-amp
b. 2. Study of Feed Back Amplifiers using Op-amp
c. 3. RC Phase shift oscillator
d. 4. Precision Circuit
e. 5. Applications of Op-amp :differentiator, integrator
f. 6. A-stable and monostable multi-vibrators
g. 7. Integrated Circuit Timer and Phase Locked Loop
h. 8. Active Low Pass, High Pass and Band Pass filters using Op-amp
i. 9. Study of DACs and ADCs
j. 10 IC Fixed and adjustable Voltage Regulators
k. 11 Magnitude comparator and window detector using Op-Amp
l. 12 Arithmetic Operation using Op-Amp

Course Outcomes

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

1. Design basic configuration of Op-Amp.
2. Design Multivibrator circuit.
3. Design Active filters
4. Design various types of oscillator circuits and differential amplifier
5. Design and test operational amplifiers-based circuits and DACs and ADCs

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year I Semester

18ECE204 SIMULATION AND CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18ECE104 & 18ECE106

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 LabVIEW.

Course Objectives

1. To Understand the representation of continuous and discrete time signals and systems in time domain.

2. To Study and analyze frequency domain versions of different systems along with their Characteristics.

3. To know concepts of Laplace transform and z-Transform, analysis of properties and characterization of LTI systems.

4. To study Error compensation study using Numerical analysis using MATLAB. Understanding of PID Controller, Control system of electrical machines.

5. To analyze stability of a given Linear Time Invariant System, various control systems using LabVIEW.

LIST OF EXPERIMENTS

Signals and System Lab:

1. Introduction to MATLAB and Signals in MATLAB.

2. Understanding the properties of signals and their transformations.

3. Characterizations of systems and their classification.

4. Convolution of Continuous Time and Discrete Time Signals.

5. MATLAB Implementation of Fourier series.

6. MATLAB Implementation of Continuous Time Fourier Transform (CTFT) and Discrete Time Fourier Transform (DTFT). .

7. MATLAB Implementation of Laplace Transform and z-Transform.

8. Sampling Theorem Verification

9. Introduction to Simulink Modeling in MATLAB.

Control Lab:

1. Transfer Function of DC Machine.

2. Effect of Feedback on DC Servo Motor.

3. Characteristics of AC Servo Motor.

4. Effect of P, PD, PI, PID Controller on Second Order Systems.

5. Lag and Lead Compensation – Magnitude and Phase Plot.

6. Temperature Controller Using PID.

7. Stability Analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant System Using MATLAB.

8. Steeper motor control using LabVIEW.
9. Water level control using LabVIEW.

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 versions of different systems along with their Characteristics.
3. Apply the Laplace transforms and Z transform for analyze the LTI system and also verify the sampling theorem.
4. Understanding of PID Controller, Control system of electrical machines.
5. Analyze stability of a given Linear Time Invariant System and various control systems using LabVIEW.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Dept. of Electronics and Communication Engineering

B. Tech II Year II Semester

18ECE205 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description

This course is designed to help the students understand the assembly language programming of 8086 microprocessor and 8051 microcontroller. Further this course provides hands on experience for interfacing peripherals with 8086 microprocessor & 8051 microcontroller.

Course Objectives

1. To gain hands on experience in writing assembly language programs on 8086 microprocessor and 805 microcontroller.

2. To interface various peripheral chips to 8086 microprocessor.

3. To learn about designing and implementing 8051 microcontroller based systems.

LIST OF EXPERIMENTS

8086 Experiments:

1. Write Assembly Language Program to perform Arithmetic operations – Multi byte Addition and Subtraction, Multiplication and Division Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

2. Write Assembly Language Program to perform Logic operations –Code Conversions.

3. Write Assembly Language Program to perform operations on arrays – Sorting and Searching

4. Write Assembly Language Program to perform String Manipulation operations by using string operations and Instruction prefix - Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison using 8086 microprocessor.

8086 Peripheral Interfacing Experiments:

5. Write Assembly Language for Reading and Writing data using parallel ports of 8255 PPI.
6. Interfacing 8279 Keyboard / Display controller to display a string message.
7. 8253 Programmable Interval Timer in different modes using 8086 microprocessor.
8. Design and Interface a Traffic Controller using 8086 microprocessor.
9. Generate an interrupt using 8259 Interrupt Controller to 8086 microprocessor.

8051 Experiments:

10. Write Assembly Language Program to perform Arithmetic operations – Multi byte Addition and Subtraction, Multiplication and Division Signed and unsigned Arithmetic operation, ASCII and BCD – arithmetic operations
11. Write an Assembly Language Program to compute the square and square root of a number.
12. Write an 8051 Assembly Language Program to interface a stepper motor with a 8051 microcontroller

Project Based Learning: Design of water level indicator using 8051.

Course Outcomes

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech III Year I Semester

B. Tech III Year I Semester

18ENG102 ENGLISH COMMUNICATION - READING AND WRITING
(Common to all branches)

L	T	P	C
2	0	0	2

Course Prerequisite: 18ENG101

Course Description: **As the s**tudents being exposed to the global language 'English; it has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regard to two particular skills, i.e. Reading and Writing. This course is offered in order to help students cultivate and nurture a mind that "think in English." Intricate issues of understanding academic texts, vocabulary needed to comprehend texts, evaluate and analyze writing tasks, etc.

Course Objectives: This course enables students to –

1. Hone in on their reading skills
2. Cultivate critical reading and writing skills
3. Develop crucial comprehension of texts, graphs and graphics
4. Enhance vocabulary for greater communicative impact
5. Overall development in the English language

UNIT 1: Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Understanding discourse. **(6)**

UNIT 2: Identifying audience; Reading for detail; using visuals; Academic vocabulary, collocations and synonyms. **(6)**

UNIT 3: Scanning to find crucial information; Using critical thinking to identify purpose; Previewing; Topic related vocabulary; Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion. **(6)**

UNIT 4: Analyzing essay questions; Writing a problem-solution based on graphs and graphics; Developing own ideas. **(6)**

UNIT 5: Writing cause-effect paragraphs; Evaluating diagrams; Brainstorming; Academic verbs and topical language. **(6)**

Course Outcomes: At the end of the course, learners will be able to

1. Read and comprehend academic texts, graphs, diagrams and graphics
2. Develop crucial thinking skills

3. Write purposefully and effectively
4. Enhance vocabulary
5. Overall development in the English language

Suggested Reading/Textbook:

1. Carolyn Westbrook; *Unlock 3 series (B1): Reading & Writing;* Published by: Cambridge University Press.

Reference:

1. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Upper Intermediate (B2+)*; Published by: Cambridge University Press.

2. Josh Sreedharan; *The Four Skills for Communication*; Cambridge University Press, 2014.

3. V. Sasikumar,P.Kiranmai Dutt, Geetha Rajeevan; *A Course in Listening & Speaking II*; Cambridge University Press, 2014.

4. Liz Driscoll; *Reading Extra*; Cambridge University Press, 2004.

5. Graham Palmer; *Writing Extra*; Cambridge University Press, 2004.

6. *Writing Tutor*; Advanced English Learners' Dictionary, 9th Edition; Oxford University Press, 2012.

7. *https://www.nypl.org/blog/2012/11/28/11-great-free-websites-practice-english*

8. *www.readbrightly.com/6-great-websites-teen-writers/*

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

B. Tech III Year I Semester

18ECE108 AI TOOLS, TECHNIQUES AND APPLICATIONS

Course Prerequisite: None

L	T	P	C
3	0	0	3

Course Description:
To understand the importance of AI and its applications, Machine learning and Deep Learning algorithms and smart solutions for various domains.

Course Objectives:
The objectives of this course are to

- Expose fundamental concepts in AI
- Demonstrate the capability to create simple AI applications using Natural Language Processing, Speech Recognition, Computer Vision, Pattern recognition.
- Present various modeling and formulation techniques to solve problems using AI techniques.
- Introduce state-of-art AI tools and techniques to solve various problems faced by Engineers in design and analysis.

UNIT I : FUNDAMENTALS OF AI
AI-Definition, Applications of AI, Search Strategies – BFS, DFS, Knowledge representation and reasoning – Knowledge based Agent, Wumpus World Environment, Logics. **Machine Learning:** Supervised Learning - Linear Regression, Logistic Regression, Unsupervised Learning – K-means clustering, Anomaly Detection, Reinforcement Learning. **(9)**

UNIT II: NLP AND BOT TECHNOLOGIES
Natural Language Processing: Natural language Understanding, Sentiment Analysis, Segmentation and recognition, Speech Recognition, Text-to-Speech, NLP in the cloud, NL Interface, **Chatbots:** Chatbot definition, Build a Chatbot, How has chatbot transformed user experience, Designing elements, best practices for chatbot development, **Virtual Assistants:** What is a Virtual Assistant? **(9)**

UNIT III: IMAGE PROCESSING &APPLICATIONS
What is Image processing?, Image Noise, Removal of Noise from Images, Color Enhancement, Fourier transforms, Feature detection and matching, Segmentation**,** Object detection, Face recognition, Recognition Databases and test sets. Application: Optical Character Recognition. **(9)**

UNIT IV DEEP LEARNING
Introduction - Neural Networks, Deep Learning, Different types of Deep Neural Networks - CNN,RNN, forward propagation, Cost function, backpropagation. APIs using Softwares Tensorflow and Keras. **(9)**

UNIT V SMART APPLICATIONS

Smart Agriculture, Smart Transportation &Autonomous Vehicles, Smart Homes, Smart cities. (9)

Course Outcomes:

Upon the completion of the course, students able to

1. Understand the basic concepts and applications of Artificial Intelligence.
2. Design Chatbots based on the user requirements
3. Identify the features of digital images for analysis.
4. Implement the deep learning techniques using software tools.
5. Develop smart applications for various domains

Textbooks:

1. Tom Markiewicz& Josh Zheng,Getting started with Artificial Intelligence, Published by O'Reilly Media,2017
2. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2010
4. Ian Goodfellow, Yoshua Bengio, Aaron Courvill, Deep Learning

References:

1. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
3. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, PHI Publications
4. Machine Learning, Rajiv Chopra, Khanna Publishing House

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

B. Tech III Year I Semester

18ECE109 ANALOG AND DIGITAL COMMUNICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: 18MAT109, 18ECE104.

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. Study the fundamental concepts of communication theory.
2. Analyze various analog continuous wave modulation and pulse modulation techniques.
3. Evaluate the performance of analog communication systems in the presence of noise.
4. Study different baseband and bandpass digital modulation techniques.
5. Study the performance of digital receivers.

UNIT I: NOISES ANALYSIS

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. **(9)**

UNIT II: ANALOG MODULATION

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. **(9)**

UNIT III: DIGITAL KEYING TECHNIQUES

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. **(9)**

UNIT IV: SHIFT KEYING TECHNIQUES

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. **(9)**

UNIT V: SIGNALS CONDITIONING
Linear Block Codes- Convolutional codes- Linear equalization and Decision Feedback techniques for band-limited channels- Adaptive Equalization- Synchronization and Carrier Recovery for Digital modulation. **(9)**

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 Books

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: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year I Semester

18ECE110 DIGITAL SIGNAL PROCESSING

L	T	P	C
2	1	0	3

Course Prerequisite: **18ECE104, 18MAT107**

Course Description

This course deals with detailed overview of discrete time signals & systems, representation of systems by means of impulse response, difference equation, convolution of discrete time signals to find the system response, correlation of discrete time signals and its application for analysis of LTI system. Various mathematical tools such DTFT, DFT, FFT, z-transform are explained followed by its application in transform domain analysis of LTI system. Furthermore, the concept of sampling is discussed for processing of continuous signals digitally. This is followed by exploring transform domain analysis of LTI discrete time systems and their realization with standard forms. Subsequently, detailed design of FIR and IIR systems are discussed for low-pass, high-pass, band-pass and band-stop filtering application. Finally, discussed about programmability digital signal processor and applications of DSP in real time.

Course Objectives

This course enables students to

1. (a) Understand basics of discrete time signals & systems and their classification
   (b) Get familiar with difference equation representation of discrete time LTI system
   (c) Study convolution & correlation and its properties and apply the same for finding response as well as analysis of discrete time LTI system.
2. Get acquainted with mathematical tools such as DTFT, DFT, FFT, z-transform and use them for the analysis of discrete time signals and LTI systems in transform domain
3. (a) Design various types of ADCs, DACs so as to process continuous signals using DSP system.
   (b) Realize FIR and IIR systems using direct, cascade and parallel forms.
4. Design IIR filter and FIR filter.
5. Acquire knowledge about real time implementation of various digital signal processing algorithms in DSP hardware.

UNIT I: INTRODUCTION

Discrete time Signal and System: Basic of discrete signal and system, comparison of analog and digital system, conversion of analog-to-digital (ADC) and digital-to-analog system (DAC), classification of discrete-time signals, and system, Analysis of discrete-time system: analysis of LTI System, difference equation analysis of LTI System, Convolution and Correlation of discrete-time signal. **(9)**

UNIT II: DISCRETE TIME SIGNAL ANALYSIS IN TRANSFORM DOMAIN

Time-Domain and Frequency domain signal properties, the discrete time Fourier transform (DTFT), Discrete Fourier transform (DFT), fast Fourier transform (FFT), Z-transform, frequency domain analysis of discrete time signals and LTI systems, analysis of LTI system with z-transform. **(9)**

UNIT III: DSP SYSTEM

Digital processing of Continuous time signals: Sampling of signals, sampling theorem, filtering process, ADC/DAC Conversion. LTI discrete-time System in Transform Domain: Types of transfer function, digital filters, all pass transfer function, inverse system. Implementation of DSP System: Structure for the realization of discrete-time systems, Structure for FIR and IIR, Representation of Numbers, Finite word length effects: Quantization of input signal, filter coefficient, Round-off effect in digital filters. **(9)**

UNIT IV: FILTER DESIGN

Basics of Analog Filter and Digital filters, Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Band-stop and High pass filters using Bilinear Transformation. **(9)**

UNIT V: DIGITAL SIGNAL PROCESSORS

Introduction to fixed point and floating point DSP processors-Harvard architecture, pipelining, Multiplier-accumulator (MAC) unit, Architecture of TMS320C6713 floating point processor - Addressing modes, Instruction set, Applications. **(9)**

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Acquire basic knowledge about discrete time signals and systems and apply the same in analyzing LTI system in time domain.
2. Understand different types of mathematical tools such as DTFT, DFT, FFT, z-transform and use them in analyzing discrete time signals and LTI system in transform domain.
3. Design A/D & D/A conversion systems for digital processing of continuous time signal and implement various structures such as direct, cascade, parallel forms for realization of FIR, IIR systems.
4. Design Digital IIR and FIR filters to meet desired frequency response specification for low-pass, high-pass, band-pass and band-stop filtering application.
5. Ability to acquire knowledge on programmability Digital Signal Processor.

Text Books

1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Pearson, 4th Edition
2. S.K. Mitra, Digital Signal Processing: A computer based approach. TMH, 4th Edition
3. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 3rd Edition

Reference Books

1. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
2. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
3. D.J. DeFatta, J. G. Lucas andW.S. Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

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

B. Tech III Year I Semester

18ECE206 AI TOOLS, TECHNIQUES AND APPLICATIONS LABORATORY

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

Course Prerequisite: None

Course Description:

Performing data labeling, building custom models, object recognition, speech recognition, building chatbot, configuring neural network, building virtual assistant, and building convolutional neural network.

Course Objectives: The objectives of this course are to

1. Perform data labelling
2. Develop custom models for object recognition
3. Build chatbot.
4. Configure neural network.

LIST OF EXPERIMENTS

1. Implement simple linear regression to predict profits for a food truck based on the population of the city that the truck would be placed in.
2. Build a classification model that estimates the probability of admission based on the exam scores using logistic regression.
3. Implement the unsupervised learning algorithm using K-means clustering
4. Implement an anomaly detection algorithm using a Gaussian model and apply it to detect failing servers on a network.
5. Liv.ai - App for Speech recognition and Synthesis through APIs
6. Building a Chatbot
7. Build a virtual assistant
8. Supervised Algorithm - Perform Data Labelling for various images using object recognition
9. Implement un-regularized and regularized versions of the neural network cost function and compute gradients via the backpropagation algorithm.
10. Build a Convolutional Neural Network for Cat vs Dog Image Classification

Course Outcomes:

At the end of the course student will be able to

1. Label the data based on object recognition
2. Develop virtual assistant using speech recognition
3. Develop Chatbots based on the user requirements
4. Design and configure Neural Networks for various real world applications
5. Create convolution neural network model for image classification

Textbooks:

1. Tom Markiewicz& Josh Zheng,Getting started with Artificial Intelligence,Published by O'Reilly Media,2017
2. Programming collective Intelligence: Building Smart Web 2.0 Applications-Toby Segaran

References:

1. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. Machine Learning with Python, Abhishek Vijayvargia, BPB publications
3. Python Machine Learning, Sebastian Raschka, packt publishers
4. Building Machine Learning systems with Python, WilliRichart Luis Pedro Coelho
5. Python Machine Learning by Example, Liu, Yuxi(Hayden),Packt Publishers
6. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach

Mode of evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech III Year I Semester

18ECE207 ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18MAT109

Course Objectives

1. Student will be able to understand the basics analog and digital modulation technique and get the real time exposure of communication system with detailed analysis of analog and digital communication techniques.

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 analog communication systems.
2. Evaluate the performance of communication systems in the presence of noise
3. Implement the various the pulse modulation schemes for digital communication
4. Demonstrate the various digital modulation technique
5. Examine the performance of coding in digital system

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

18ECE208 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: 18ECE104

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 standard discrete time signals followed by implementation of basic operations on discrete time signals. Convolution and correlation of discrete time signals are implemented. Furthermore, 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

1. To get familiar with various operations on discrete time signals and apply the same in implementing convolution and correlation of discrete time signals
2. To analyse spectrum of discrete time signal using DFT
3. To design digital IIR and FIR filters for low-pass and high-pass filtering
4. To analyse Multirate DSP system by implementing Interpolator and Decimator
5. To acquire knowledge about implementation of digital systems for noise filtering application

LIST OF EXPERIMENTS

MATLAB based Experiments

1. Generation of Various signals and Sequences: Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, random signals.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Convolution (Linear and Circular) between Signals and Sequences.
4. Autocorrelation and Cross correlation between Signals and Sequences.
5. Spectrum analysis using DFT
6. IIR filter (LP/HP) Design using bi-linear transformation techniques
7. FIR filter (LP/HP) Design using window techniques
8. Analysis of Multi-rate DSP
9. Application od DSP: Noise Filtering

DSP Processor based Experiments

1. Study of DSP Processor and its architecture
2. Generation of Various signals and Sequences: Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, random signals.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Linear and Circular Convolution
5. Auto-correlation and Cross-correlation
6. FFT Implementation

7. FIR Filter design using Window Techniques (Rectangular, Triangular and Kaiser)
8. IIR Filter design

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Implement addition, multiplication, scaling, shifting, folding operations on discrete time signals and apply the same for computing convolution and correlation of discrete time signals in MATLAB and then using DSP processor
2. Analyse magnitude and phase spectrum of discrete time signal using DFT in MATLAB and implement FFT algorithm for the same using DSP processor
3. Design Digital IIR and FIR filters in MATLAB by using Bilinear transformation and Windowing technique respectively and Implementation of the same through DSP processor
4. Implement Interpolator and Decimator for the analysis of Multirate DSP system in MATLAB.
5. Design digital filter in MATLAB to suppress noise and extract the required information from the noisy signal

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

B. Tech III Year II Semester

18ECE111 INTERNET OF THINGS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The Internet of Things (IoT) is a network of a wide variety of devices like vehicles, humans, soil etc. These devices gather data using sensors, which can be used for monitoring or control. 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 fundamental concepts of IoT and physical computing
2. Expose the student to a variety of embedded boards and IoT Platforms
3. Create a basic understanding of the communication protocols in IoT communications.
4. Familiarize the student with application program interfaces for IoT.
5. Enable students to create simple IoT applications.

UNIT I - OVERVIEW OF IOT

The Internet of Things: An Overview; The Flavor of the Internet of Things; The “Internet” of “Things”; The Technology of the Internet of Things; Enchanted Objects; Who is Making the Internet of Things?; Design Principles for Connected Devices; Calm and Ambient Technology; Privacy; Keeping Secrets; Whose Data Is It Anyway?; Web Thinking for Connected Devices; Small Pieces, Loosely Joined; First-Class Citizens On The Internet; Graceful Degradation; Affordances **(9)**

UNIT II - EMBEDDED DEVICES – I (ARDUINO)

Embedded Computing Basics; Microcontrollers; System-on-Chips; Choosing Your Platform; Arduino; Developing on the Arduino; Some Notes on the Hardware; Openness; **(9)**

UNIT III - EMBEDDED DEVICES – II (RASPBERRY PI)

Raspberry Pi ; Cases and Extension Boards; Developing on the Raspberry Pi; Some Notes on the Hardware; Openness; Other notable platforms; Mobile phones and tablets; Plug Computing: Always-on Internet of Things **(9)**

UNIT IV - COMMUNICATION IN THE IOT

Internet Principles; Internet Communications: An Overview ; IP; TCP; The IP Protocol Suite (TCP/IP); UDP ; IP Addresses; DNS ; Static IP Address Assignment ; Dynamic IP

Address Assignment; IPv6 ; MAC Addresses ; TCP and UDP Ports ; An Example: HTTP Ports ; Other Common Ports; Application Layer Protocols- HTTP; HTTPS: Encrypted HTTP ; Other Application Layer Protocols. **(9)**

UNIT V - PROTOTYPING ONLINE COMPONENTS

Getting Started with an API; Mashing Up APIs; Scraping; Legalities; Writing a New API; Clockodillo; Security; Implementing the API; Using Curl to Test; Going Further; Real-Time Reactions; Polling; Comet; Other Protocols ; MQ Telemetry Transport; Extensible Messaging and Presence Protocol; Constrained Application Protocol. **(9)**

Course Outcomes:

After completing this Unit, 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 using APIs

Text Books

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2014, ISBN:978-1-118-43062-0.

2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books:

1. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases, CRC Press. 2017. ISBN: 978-1498761284.

2. Matt Richardson & Shawn Wallace, Make:Getting Started with Raspberry Pi, O'Reilly, 3rd Edition, 2016, ISBN:978-1-680-45246-4.

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

B. Tech III Year II Semester

18ECE112 ELECTROMAGNETIC WAVES AND WAVEGUIDES

L	T	P	C
2	1	0	3

Course Prerequisite: 18PHY101

Course Description

This course covers vector algebra, electrical field intensity, Maxwell's equations, conductors, dielectrics, polarization, Pointing Theorem, provide basic understanding on electromagnetic waves and transmission lines, especially waveguides.

Course Objectives

This course enables students to

1. Understand the concepts of electromagnetic fields and boundary condition at media interface.
2. Understand the basics of uniform plane waves and its propagation.
3. Analyse the reflection and refraction of electromagnetic waves and plane waves at a media interface.
4. Analyse the wave propagation in parallel plate waveguide.
5. Learn transmission line theory.

UNIT I: CONCEPT OF ELECTROMAGNETIC AND MAXWELL EQUATION

Basic of Vector, Vector Calculus: Gradient, Divergence, curl, Line and surface integral. Basic law of Electromagnetic**,** Basic of Maxwell equation in integral and differential form, Boundary condition at media interface. **(9)**

UNIT II: UNIFORM PLANE WAVES

Basic Concept of Uniform plane wave, Propagation of wave in free space, Wave polarization, Wave polarization at different interface, Wave propagation in dielectric and conducting medium, phase and group velocity, Pointing vector, Surface current and skin effect in a conductor. **(9)**

UNIT III: REFLECTION & REFRACTION OF PLANE WAVE

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, Reflection from a conducting boundary. **(9)**

UNIT IV: WAVEGUIDES

Wave propagation in parallel plate waveguide: TE, TM, TEM Modes, Analysis of waveguide general approach, Mode analysis of Rectangular waveguide, Surface currents on the waveguide walls, Field visualization. Rectangular Cavity resonator and Q-factor. **(9)**

UNIT V: TRANSMISSION LINE ANALYSIS

Transmission Line Equations, Primary & Secondary Constants, Infinite Line Concepts, Lossless / Low Loss Characterization, Distortion Condition for Distortion-less and Minimum Attenuation, Loading -Types of Loading Input Impedance Relations, SC and OC Lines, Reflection Coefficient, SWR,$\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations, Load Matching-Single stub, Smith Chart and its Applications. **(9)**

Course Outcomes

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

1. Use Gradient, Divergence and Curl along with fundamental Theorems. Use Maxwell's equations for analyzing time varying electromagnetic Phenomena.
2. Estimate free space losses and signal power for engineering radio links.
3. Learn about reflection and refraction of wave.
4. Design direction couplers and Resonator using waveguides.
5. Design impedance matching circuits using transmission lines.

Text Books

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, 2ndEdition,2000.

Reference Books

3. R.K.Shevgaonkar, " Electromagnetic Waves", McGraw Hill , 2017.
4. Inan, Umran S., Ryan K. Said, and Aziz S. Inan. "Engineering electromagnetics and waves. Pearson", 2014.

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

B. Tech III Year II Semester

18ECE113 VLSI DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE102

Course Description

This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET, CMOS processing technology, circuit characterization and performance estimation, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives

This course enables students to

1. Know the different VLSI Design Methodologies
2. Understand the characteristics of CMOS device
3. Study CMOS design rules
4. Designing of CMOS by considering the low power
5. Understand different types of CMOS circuit families

UNIT I: INTRODUCTION TO VLSI DESIGN METHODOLOGIES

Introduction to VLSI Design Methodologies, Scaling, CMOS Logic: Inverter, NAND Gate, NOR Gate, Combinational Logic, Compound Gates, Pass Transistors and Transmission Gates, CMOS Inverter Cross-section, Stick Diagrams. VLSI Design Flow, Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin. **(9)**

UNIT II: MOS TRANSISTOR THEORY

MOS Ideal I-V Characteristics, C-V Characteristics, MOS Small-signal Model, MOS Capacitance Models, MOS Gate Capacitance Model, MOSFET as a Switch, non-ideal I-V Effects: Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, Sub-threshold Conduction, Junction Leakage, Tunneling. **(9)**

UNIT III: CMOS TECHNOLOGIES

CMOS Technologies: Background, Wafer Formation, Photolithography, Well and Channel Formation, Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology. Scribe Line and Other Structures, MOSIS Scalable CMOS Design Rules, Micron Design Rules. **(9)**

UNIT IV: LOW POWER DESIGN

Delay Estimation using RC Delay Model and Linear Delay Model, Logical Effort, Parasitic Delay. Logical Effort and Transistor Sizing: Delay in a Logic Gate, Delay in Multistage Logic Networks, choosing the Best Number of Stages. Power Dissipation: Static Dissipation, Dynamic Dissipation, Low-Power Design. Interconnect: Resistance, Capacitance, Delay, and Crosstalk.**(9)**

UNIT V: CIRCUIT FAMILIES

Circuit Families: Static CMOS, Ratioed Circuits, Cascade Voltage Switch Logic, Dynamic Circuits, Sense Amplifier Circuits, Bi-CMOS Circuits, Multiplexers, Sequential Static Circuits, Design of Latches and Flip-Flops. **(9)**

Course Outcomes

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

1. Explain the VLSI design methodologies and basic CMOS circuits used in modern Integrated circuits applications.
2. Discuss the fundamentals of MOS transistor theory.
3. Discuss about the CMOS processing technology.
4. Discuss about the integrated circuit characterization and performance estimation.
5. Describe the different types of circuit families.

Text Books

1. J. P. Uyemura: Introduction to VLSI Circuits and Systems, Wiley.
2. Neil H.E. Weste, David Harris, Ayan Banerjee: CMOS VLSI Design, Third Edition, Pearson Education.
3. Neil H.E. Weste, Kamran Eshraghian: Principle of CMOS VLSI Design, Pearson Education.

Reference Books

1. Philip E. Allen and Douglas R Holberg: CMOS Analog Circuit Design, Oxford.
2. Carver Mead and Lynn Conway: Introduction to VLSI systems, BS Publication.
3. Plummer: Silicon VLSI Technology, Pearson Education.
4. J. P. Uyemura: Chip Design for Submicron VLSI, Cengage Learning.

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

B. Tech III Year II Semester

18ENG202 CORPORATE COMMUNICATION LABORATORY
(Common to all branches)

L	T	P	C
0	0	2	1

Course Prerequisite: 18ENG201

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.

Course Objectives:
This course enables the student to
1. Develop their communicative competency
2. Focus on their interactive skills
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 & SPEAKING
Group discussion, Interview Skills, Presentation Skills, Role Plays, Small Talks, listening to and understanding Lectures, News, Discussions, Debates, Theatre, Movies, etc.

UNIT II: READING & WRITING
Reading a plethora of writing from Newspapers to Philosophical Treatise, Understanding Graphics, Interpreting, Summerizing, Etc.

UNIT III: VERBAL & NON-VERBAL ASPECTS
Speaking- introducing oneself - exchanging personal information- Language development- ‘Wh’-Questions- asking and answering-yes or no questions-asking about routine actions and expressing opinions.

UNIT IV: STORYTELLING & CONVERSATIONS
Listening-short texts-formal and informal conversations-participating in conversations- short group conversations- speaking about oneself- speaking about one’s friend.

UNIT V: BUSINESS ENVIRONMENT & ETIQUETTES
Saring information of a personal kind; greeting; taking leave; Writing e-mails, memos, reports, etc.

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 and personal letters and emails in English.

Suggested Reading/Textbook:
1. Meenakshi Raman &Sangeetha Sharma; Technical Communication – Principles and Practice (2^{nd} Edition-2014); Oxford University Press –2014
2. Michael Swan & Catherine Walter; How English Work (9^{th} Edition); Oxford University Press - 2001

Reference:
1. Nutall J. C.; Reading Comprehension; Orient Blackswan
2. Jane Willis; Teaching English through English; Published by Longman Handbooks
3. www.cambridgeenglish.org/in/
4. https://learnenglish.britishcouncil.org/en/english-grammar
5. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

18ECE209 INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:

This course provide hands-on practices on IoT using Arduino & Raspberry microcontrollers with various interfaces such as sensors, actuators, mobile app, cloud, social media.

Course Objectives:

1. To understand working principles of IoT devices
2. To get exposure towards the IoT internals
3. To understand the concepts of real world designs, industrial automation and commercial needs for designing IOT enabled solution

LIST OF EXPERIMENTS

1. Study on IoT Platform
a) Getting information and study of IOT microcontrollers (Arduino, Resperrypi)

2. **Study on IoT Platform**
a) Getting information about Sensors (IR, temperature, pressure, gas sensor)
b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

3. **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

4.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.

5.Programming with Resperrypi
   a) Displaying Date on Serial Monitor
   b) Automated Door Opening System

6.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 Bluetooth.

7. 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

8. 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.

9. **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

10. Data analysis and Visualization
Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

11. Social media with IoT
Creating Program for Local host Web Server for controlling devices and update status on Twitter through Arduino.

12. 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:
At the end of the course, students will be able to

1. Choose the sensors and actuators for an IoT application
2. Select protocols for a specific IoT application
3. Utilize the cloud platform and APIs for IoT application
4. Experiment with embedded boards for creating IoT prototypes
5. Design and develop a solution for a given IoT application

Text/ Reference Books:

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2014, ISBN:978-1-118-43062-0.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547
3. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases, CRC Press. 2017. ISBN: 978-1498761284.
4. Matt Richardson & Shawn Wallace, Make:Getting Started with Raspberry Pi, O'Reilly, 3rd Edition, 2016, ISBN:978-1-680-45246-4.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech IV Year I Semester

B. Tech IV Year I Semester

18ECE114 MICROWAVE ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: 18PHY101, 18ECE112

Course Description

This course deals about RF spectrum of microwaves history and applications of microwaves in civil military medical and safety consideration and modern in microwave engineering. Learn to design micro strip line, power dividers, power couplers and study the methods to analyze these devices using various methods. Study about solid state microwave devices and their use in designing microwave amplifiers. Finally learn about microwave measurement devices and test-bench setup to measure different parameters like VSWR, impedance and frequency of microwave device.

Course Objectives

This course enables students to

1. Introduce RF & microwave spectrum, history and applications of microwaves.
2. Define Scattering parameters to characterize devices and system behavior.
3. Design power handling devices and filters at microwave frequency range.
4. Understand and study sources utilized in microwave systems.
5. Introduce various microwave measurements.

UNIT I: INTRODUCTION

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. **(5)**

UNIT II: MICROWAVE NETWORKANALYSIS

Scattering matrix - reciprocal networks and lossless networks, generalized S-parameters – signal flow graph–decomposition of signal flow graphs. S-matrix analysis of E-Plane Tee, H-plane Tee, Magic Tee, Multi-hole directional coupler.

(9)

UNIT III: MICROWAVE DEVICE DESIGN

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. **(11)**

UNIT IV: MICROWAVE SOURCES AND AMPLIFIERS

Microwave Tubes: TWT, -TRAPATT diodes, Klystron amplifier, Reflex Klystron, Magnetron.
Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT PIN Diode.
Microwave Transistors: BJT, FET, MESFET.
Microwave amplifiers: Two port power gains, stability of the amplifier- design of single stage amplifier for maximum gain. **(11)**

UNIT V: MICROWAVE MEASUREMENTS

VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, impedance Measurement at microwave frequency, scattering parameters, Noise at microwave frequency and measurement of noise figure. **(9)**

Course Outcomes

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

1. Understand RF spectrum, its application and history of microwaves.
2. Analyze microwave circuits with scattering matrix and signal flow graphs
3. Design and analyze power dividers and couplers at microwave frequencies
4. Analyze different microwave sources and microwave amplifiers which are used in industries.
5. Gain knowledge about measurement methods and devices used at microwave frequencies.

Text Books

1. Microwave Engineering, M. Pozar, Willey & Sons Inc. 4th Edition, 2011
2. Microwave Devices and Circuits, Samuel Y. Lio , Pearson, 3rd edition, 2003

References Books:

1. Foundation of Microwave Engineering, S. Vasuki, D. Margaret Helena, R. Rajeswari McGraw Hill. 1st edition, 2015
2. Microwave Engineering, A Das & S Das. Mc Graw Hill, 3rd Edition, 2017
3. Microwave Engineering- Passive Circuits, P.A Rizzi, Prentice Hall,1988

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

B. Tech IV Year I Semester

18ECE115 COMPUTER COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course develops 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. Understand the basic concepts of the data communication and layered architecture.
2. Acquire knowledge in data link layer on coding, flow control, error control and MAC layer.
3. Understand the basics of IP addressing and the network protocols in network layer.
4. Acquire the knowledge involved in connection-oriented and connectionless protocol, congestion control and QoS related to transport layer.
5. Understand the requirement of user to machine interfacing application layer protocols, multimedia and security.

UNIT I: DATA COMMUNICATION COMPONENTS
Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, TCP/IP Model, Border Gateway Protocol (BGP), Asynchronous Transfer Mode (ATM), 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. **(9)**

UNIT II: DATA LINK LAYER
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. **(9)**

UNIT III: NETWORK LAYER
Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. **(9)**

UNIT IV: TRANSPORT LAYER
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. **(9)**

UNIT V: HIGHER LAYERS
Client Server Model, Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Multimedia, Bluetooth, Firewalls, Cryptography. **(9)**

Dept. of Electronics and Communication Engineering

Course Outcomes

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

1. Describe the phases, identify, list and compare aspects of Data Network.
2. Understand the characteristics and selection of suitable Data link and MAC layer protocols for computer communication networks.
3. Classify and select suitable masking and routing techniques in Network layer for large network.
4. Discuss and identify suitable protocols in Transport layer to be applicable for computer communication networks.
5. Sketch a network including aspects of application layer for computer communication networks.

Text Books

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill, 4th Edition, 2007
2. Data and Computer Communication, William Stallings, Pearson Education,8th Edition, 2007

Reference Books

1. Computer Networks, Andrew S.Tanenbaum, Pearson New International Edition, 2013
2. Internetworking with TCP/IP, Douglas Comer, Prentice Hall of India, Volume 1, 6th Edition, 2015
3. TCP/IP Illustrated, W. Richard Stevens, Addison-Wesley, United States of America, Volume 1,2nd Edition,2011

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

B. Tech IV Year I Semester

18ECE210 MICROWAVE ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Course Prerequisite: 18ECE112

Course Description

This 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 also 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. Understand the characteristics of reflex klystron and Gunn diode.
2. Measure attenuation, VSWR, and impedance
3. Analyze the waveguide parameters of microwaves devices
4. Measure radiation pattern of given antenna
5. Understand microwave devices simulation tool

List of Experiments

1. Characteristics of Klystron tube and to determine its electronic tuning range.
2. a. Gunn Diode characteristics.
   b. Output power and frequency as a function of voltage.
3. Square wave modulation through diode.
4. Attenuation measurement.
5. Directional Coupler Characteristics.
6. Waveguide parameters measurement.
7. VSWR measurement.
8. Impedance measurement.
9. Scattering parameters of Magic Tee.
10. Radiation pattern measurement.
11. CST microwave studio software introduction with filter design.
12. Power divider and combiner design in CST microwave studio.
13. Antenna design in CST microwave studio.

Course Outcomes

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

1. Analyze the microwave bench working.
2. Analyze the reflex klystron and Gunn diode characteristics
3. Analyze the SWR and impedance measurement techniques.
4. Understand about measurement of scattering parameters.
5. Understand basic simulation of microwave devices using CST microwave studio.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech IV Year I Semester

18ECE211 COMPUTER COMMUNICATION NETWORKS LABORATORY

L	T	P	C
0	0	2	1

Course Prerequisite: None

Course Description:
This course develops a practical understanding of modern network architectures from a design and performance perspective.

Course Objectives:
This course enables students to

1. Develop an understanding of LAN and LINUX Environment and HTTP configuration.
2. Learn the basics of network programming with respect to client and server
3. Learn the configuration of FTP Server and to analyze FTP traffic .and also, to provide the idea about DNS and DHCP server.
4. Understand the concept of TCP, RIP and OSPF protocols and congestion control of TCP protocol.
5. Analyze the network traffic and understand the device communication using Wireshark

LIST OF EXPERIMENTS

1. Implementation of star and bus topologies
2. Configuration of Hubs, Switches and Routers as well as implementation of ARP protocol
3. Implementation of IP configuration and Sub netting.
4. Implementation of Distance vector routing and Link state routing algorithms
5. Configuration of DHCP server
6. Configuration of DNS server
7. Introduction about discrete events simulation and its tools: Installation of NS3 in Linux environment.
8. Implementation of various network topologies and measure network performance using flow monitor
9. Implementation of CRC-16, CRC-32 and Hamming window techniques for both Error techniques correction and detection
10. Implementation of ARQ: Stop and Wait Go Back-N and selective repeat protocols
11. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD and ALOHA protocols.
12. Implementation of TCP/UPD protocols and simulation of Congestion Control Algorithms
13. Study of HTTP Traffic using Wireshark
14. Study of FTP using Wireshark

Course Outcome:

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

1. Understand clear about LAN and Linux Operating system.

2. Demonstrate the network programming concept with respect to client and server.

3. Demonstrate the working principle of FTP, DNS and DHCP servers.

4. Demonstrate the working principle of TCP, RIP and OSPF protocols.

5. Understand the flow of traffic in the computer networks.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

OPEN ELECTIVE II

Open Elective - II

18MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

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

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

(9)

UNIT-II: Solutions of system of Algebraic Equations

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

(9)

UNIT-III: Interpolation & Numerical Calculus

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

(9)

UNIT-IV: Numerical Solutions to Ordinary Differential Equations

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

(9)

UNIT-V: Numerical Solution to Partial Differential Equations

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

(9)

Course Outcomes

At the end of this course, students should 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, Khanna Publishers, 35th Edition, 2010.
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

18MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Course prerequisite:18MAT101,18MAT106, 18MAT104, 18MAT108, 18MAT109.

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 solvedynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

Unit 1: Classical optimization. (9)

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 2: Linear programming problem. (9)

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 3: Transportation problem and assignment problem. (9)

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

Unit 4: Dynamic programming. (9)

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

Unit 5: Projectmanagementand Queuingmodels. (9)

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 the students should 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 andassignment problems in engineering situations.
4. Applythe Bellman principle of optimality to solvedynamic 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.

References:

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, Internal Mid Examinations, External End Examination.

Dept. of Electronics and Communication Engineering

Open Elective - II

18PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:

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

Course Objectives:

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

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

(9)

UNIT II: ABERRATIONS AND OPTICAL INSTRUMENTS

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.

(9)

UNIT III: WAVE OPTICS & INTERFERENCE

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).

(9)

UNIT IV: DIFFRACTION & POLARISATION

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.

(9)

UNIT V: FIBER OPTICS

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.

(9)

Course Outcomes:

Upon completion of this course the students shall 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 Book:

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

18PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisite: 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
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.

(9)

UNIT II: GASES AND LIQUIDS LASING MEDIUM
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.

(9)

UNIT III: SOLID STATE LASERS
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);

(9)

UNIT IV: PULSED OPERATION OF LASERS
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.

(9)

UNIT V: LASER APPLICATIONS
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

(9)

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

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
5. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
6. Principles of Laser: O. Svelto
7. Laser Physics: Peter W Miloni, Joseph H Eberly.

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

Dept. of Electronics and Communication Engineering

Open Elective - II

18CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

Course 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 Objective:
1. To get exposure to the basic concepts of petroleum refining.
2. To understand the basic properties of various fuels, additives and their importance.
3. To introduce the basic concepts of refining processes and technologies.
4. To familiarize the basic concepts of catalysis and various catalysts used in the refinery.
5. To understand the safety and environmental issues in petroleum industry

UNIT I: BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING
Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant(ETP). Properties and quality control of fuel: Density, Viscosity, Pour Point, Flashpoint, Fire Point, Octane Number, Cetane Number, Ductility, Water Content, Sulphur Analysis, Micro Carbon Residue Test(MCRT), Saturate, Aromatic, Resin and Asphaltene(SARA), High Frequency Reciprocating Rig(HFRR), Calorific Value.

(9)

UNIT II: CHEMICAL ADDITVES IN PETROLEUM INDUSTRY
Types of products in the refinery and their structural properties, Neutralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity modifiers, drag reducing agents, antioxidants, Lubrication modifiers, Antifoam agents, Oil spill absorbers, Dispersants, Chemicals used for ETP plant.

(9)

UNIT III: ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY
Hydrocracking reactions, Hydrocracking feedstock's, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts, Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design for Fluidized-Bed Catalytic Cracking Units

(9)

UNIT IV: ROLE OF CATALYSTS AND BIOPROCESSES IN PETROLEUM INDUSTRY
Types of catalyst and their importance, Design and selection of catalyst. Catalytic processes. Bioprocesses: Introduction, Refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, isopropanol.

(9)

UNIT V: SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY

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, safety measures, Different elements and their role in Occupational safety and Management.

(9)

Course Outcomes:

At the end of the course, the students will

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 and Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009

2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, Chizine Publ., 2017

REFERENCE BOOKS:

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013

2. Petroleum Engineering Handbook (Vol. 1 - 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.

4. S. P. Srivastava and Jenő Hancsók, Fuels and fuel additives, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.

5. Robert O. Anderson, Fundamentals of the Petroleum Industry–University of Oklahoma Pres, 1987.

6. James G. Speight, Handbook of Petroleum Product Analysis, John Wiley & Sons, Inc, 2015

7. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company), 2004

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

Dept. of Electronics and Communication Engineering

Open Elective - II

18CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

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

Course Prerequisite: Basic Engineering Chemistry 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, solvents and green processes for nanoscience.

Course Objectives:

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 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

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.

(9)

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

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. Recycling of catalyst.

(9)

UNIT 3: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: carbondioxide, water - water as a reaction solvent, water based coatings, Ionic liquids as solvent.

(9)

UNIT 4: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell, SOFC and PEMFC), Photochemical Reactions: Advantages and Challenges of Photochemical Processes, Example-Caprolactum, chemistry Using Microwaves: heating, assisted Reactions, Sonochemistry.

(9)

UNIT 5: GREEN PROCESSES FOR NANOSCIENCE

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing 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

(9)

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, 4^{th} Edition, Oxford University Press, USA 2005.

Reference Books :

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Nanoscience, wiley-VCH
2. V.K. Ahluwalia , M. Kidwai, New trends in Green chemistry, 2004, Springer.
3. Benny Joseph, Environmental Science and Engineering, TATA Mc Graw Hill, New Delhi 2006.
4. Albert Matlack, Introduction to Green Chemistry, Second Edition CRC press, 2010

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

Open Elective - II

18HUM301 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

Course Description: Intellectual property (IP) is a legal term that refers to creations of the mind. Examples of intellectual property include music, literature, and other artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Under intellectual property laws, owners of intellectual property are granted certain exclusive rights. Some common types of intellectual property rights (IPR) are copyright, patents, and industrial design rights; and the rights that protect trademarks, trade dress, and in some jurisdictions trade secrets. Intellectual property rights are themselves a form of property, called intangible property.

Course Objectives: The course is intended to:

1. Explain the importance of Intellectual Property Rights, its protection and management;
2. Explain the types/tools of IPR;
3. Make aware the students to understand the commercialization of IPR;
4. Know the filing of patent rights, acts, rules & portfolio analysis, management, patent strategy; and
5. Create awareness about Right to Information Act (RTI), its powers, functions, penalties and appeal.

UNIT I: INTRODUCTION:

Intellectual property and its protection, WTO, TRIPS Agreement& its Protection

(9)

UNIT II: INTRODUCTION TO COPYRIGHTS

Copyright Principles – Copyright Law - Copyright ownership - Right to prepare derivative works – Rights of Distribution - Copyright Formalities and Registrations - Copyright disputes - International Copyright Law – Patent Trademark – Geographical indications

(9)

UNIT III: COMMERCIALIZATION OF IP ASSETS:

Contracting, Licensing, Assignment and technology transfer; Drawing up a business strategy IP rights in export markets; Ownership of rights by employees; Valuation of intellectual property rights.

(9)

UNIT IV: PROCEDURE FOR FILING PATENT IN INDIA AND OTHER COUNTRIES,

PCT filing, Patent Search, Patent Acts & Rules, Patent Infringement, Patent Portfolio analysis and management, Patent Strategy.

(9)

UNIT V: RTI

Introduction – Objectives – Obligation of Public Authorities – The Central & State information commission – Powers & Functions – Penalties & Appeal.

(9)

Course Outcomes:

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

1. Understand the importance of Intellectual Property Rights, its protection and management.
2. Analyze and apply the types/tools of IPR.
3. Identify the process of commercialization of IPR.
4. Understand the procedure of filing of patent, acts, rules and portfolio analysis, management, patent strategy.
5. Apply the Right to Information Act (RTI) in real life situation.

Text Book:

1. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th Edition (2013) By **Deborah E. Bouchoux, Cengage Learning**

References:

1. Latest Research Papers

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

Open Elective - II

18HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

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; and
5. Explain the industrial relations, trade unions, Ethics and fair treatment at work.

UNIT I: INTRODUCTION

Understanding the nature and scope of Human Resource Management- Definition, Functions / objectives, organization of department.

(9)

UNIT II: HUMAN RESOURCE PLANNING

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.

(9)

UNIT III: RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL

Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

(9)

UNIT IV: TRAINING AND DEVELOPMENT

Training v/s development – Training Methods - challenges in training - Career development – Reward Management – Performance Appraisal – Compensation Management.

(9)

UNIT V: INDUSTRIAL RELATIONS, TRADE UNIONS

Industrial Relations, Trade unions, resolving dispute- Labor Movement - Trade Union in India, Collective Bargaining: Process and Methods, Grievance: Sources and process of Redressal, Managing Ethical issues in Human Resource Management- Ethics and fair treatment at work.

(9)

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; and
5. Examine the industrial relations, trade unions, employee safety and health measures.

Text Books:

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.

References:

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.

Open Elective II

18HUM304 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

Open Elective - II

18CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geosynthetics; improvement of expansive soils.

Course Objectives

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

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.

(9)

UNIT II: DENSIFICATION

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.

(9)

UNIT III: STABILIZATION

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

(9)

UNIT IV: REINFORCED EARTH & GEOSYNTHETICS

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.

(9)

UNIT V: EXPANSIVE SOILS

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

(9)

Course Outcomes

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

1. Identify 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. Use admixtures in stabilizing the soil.
4. Use geo-synthetics materials in engineering applications.
5. Suggest different 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.
2. Moseley M.P., Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA, 1993.
3. Xanthakos P.P., Abramson, L.W and Brucwe, D.A., Ground Control and Improvement, John Wiley and Sons, New York, USA, 1994.
4. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercy, USA.

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

Open Elective - II

18CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

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

Course Objectives

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

UNIT I: CONCEPTS AND METHODOLOGIES IN EIA

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.

(9)

UNIT II: IMPACT OF DEVELOPMENTAL ACTIVITIES

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.

(9)

UNIT III: IMPACT ON VEGETATION AND WILD LIFE

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

(9)

UNIT IV: ENVIRONMENTAL AUDIT

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.

(9)

UNIT V: ENVIRONMENTAL POLLUTION ACTS

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.

(9)

Course Outcomes

The students after completing the course will be able to:

1. Utilize the various methods used in predicting environmental impacts.
2. Utilize site information to interpret impacts on land and groundwater.
3. Outline the environmental impacts of various development activities on existing ecosystem.
4. Utilize the procedures and various protocols involved in preparation of environmental audit report.
5. Utilize 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.

Dept. of Electronics and Communication Engineering

Open Elective - II

18CE303 WATERSHED MANAGEMENT

	L	T	P	C
Course Prerequisites: None	**3**	**0**	**0**	**3**

Course Description

Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect inwatershed 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: 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.

(9)

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.

(9)

UNIT II

WATERSHED MODELING: 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.

(9)

UNIT III

EROSION AND SEDIMENTATION: 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.

(9)

UNIT IV

WATER HARVESTING: 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 modeling - environmental guidelines for water quality.

(9)

UNIT V

COVER MANAGEMENT: 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.

(9)

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 (4^{th} Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Reference Books

1. JVS Murthy. Watershed Management. New Age International publisher.
2. A.M. Michel and T.P. Ojha. Hand Book on Agricultural Engineering, Volume 2.

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

Open Elective - II

18ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The purpose of this course is to introduce the student to enrich their knowledge on the materials science field. Begin with the microscopic level the structure at the atomic and their impact on the material properties are discussed. Electronic and related conductivity of materials and respective origins are studied. Substantial part of this course is dedicated in study of magnetism and its origin in the materials along with suitable applications. Last unit is dedicated towards photonic materials.

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
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

(9)

UNIT II: CRYSTAL IMPERFECTIONS AND DIFFUSION.
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.

(9)

UNIT III: ELECTRICAL PROPERTIES OF MATERIALS
Introduction and Electrical Conduction: Ohm’s Law, Electrical Conductivity, Electronic and Ionic Conduction, Energy Band Structures in Solids, Electron Mobility, Electrical Resistivity of Metals
Semiconductivity: 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.

(9)

UNIT IV: MAGNETIC PROPERTIES OF MATERIALS
Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity. **(9)**

UNIT V: PHOTONIC MATERIALS

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

(9)

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.

References:

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

18ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:

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:

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.

(9)

UNIT II:

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.

(9)

UNIT III:

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.

(9)

UNIT IV:

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.

(9)

UNIT V:
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. **(9)**

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 Book:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

References:
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

18ME303 BASIC THERMODYNAMICS

L	T	P	C
3	0	0	3

Course Prerequisite: Differential Equations

Course Description:

Thermodynamics is one of the fundamental courses in the study of mechanical engineering. The principles of thermodynamics are applicable to a wide range of problems encountered in all branches of engineering. Also thermodynamics is an essential pre-requisite for subsequent courses in mechanical engineering like fluid mechanics, applied thermodynamics, heat transfer, gas dynamics, refrigeration and air conditioning, etc. This course is designed to equip the students with a thorough understanding of basic concepts of thermodynamics and with necessary skills and techniques to solve problems in thermodynamics through a systematic analysis using fundamental principles. The specific topics to be covered in the course include concepts of system and surroundings, energy, energy transfer by work and heat, properties of substances and property changes, first and second laws of thermodynamics.

Course Objectives:

1. To introduce the concepts of system, surroundings, energy interactions, thermodynamics properties of substances and to teach different techniques used for estimating the properties like gas laws and property tables
2. To explain the principles of work and energy.
3. To introduce the fundamentals of thermodynamic laws, concepts and principles.
4. To teach the systematic approach to be employed for effectively solving the problems in thermodynamics.
5. To explain the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Refrigeration and Air conditioning systems.

UNIT 1: THERMODYNAMIC BASICS

Macroscopic versus Microscopic viewpoint, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, Homogeneous and heterogeneous systems, Thermodynamic equilibrium, Quasi-static process, Concept of continuum, Zeroth law of thermodynamics, temperature scale, Ideal gas, Work Transfer, Heat transfer, First law of thermodynamics, Specific heat, Enthalpy, Internal Energy, Steady flow energy equation and application, PMM1 and Steady flow energy equation. **(9)**

UNIT 2: PROPERTIES OF PURE SUBSTANCES

Pure substance, Vapor-Liquid-Solid-Phase equilibrium in a pure substance, Independent properties of a pure substance, Phase boundaries, tables of thermodynamic properties, Thermodynamic Surfaces, p-v and p-T diagram for a pure substance, p-v-T surface, T-s and h-s or Mollier diagram for a pure substance, dryness fraction, Steam Tables, Charts of Thermodynamic properties, Measurement of steam quality. **(9)**

UNIT 3: SECOND LAW OF THERMODYNAMICS AND ENTROPY

Qualitative difference between heat and work, cyclic heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, Refrigerator and heat pump, Equivalence of Kelvin-Planck and Clausius statement, Reversibility and Irreversibility, Carnot cycle, Reversed heat engine, Carnot's Theorem, Corollary of Carnot's theorem, absolute thermodynamic temperature scale and Efficiency of heat engine, Entropy, Inequality of Clausius, Temperature-Entropy plot, Entropy generation in an open and closed system and Entropy change in an Irreversible process. **(9)**

UNIT 4: THERMODYNAMIC PROPERTY RELATIONS AND GAS MIXTURES

Equation of state, Ideal gas, Real gas, Compressibility chart, Internal energy, enthalpy, entropy, specific heats and Gibbs free energy of gas mixture, Maxwell's Equations, TdS equation, Difference in heat capacities, Ratio of heat capacities, Joule-Kelvin Effect, Clausius-Clapeyron equation, Properties of atmospheric air, Psychrometric chart and Psychrometric process. **(9)**

UNIT 5: THERMODYNAMIC CYCLES

Rankine cycle, Actual vapour cycle processes, Comparison of Rankine and Carnot cycles, Air standard cycles - Otto, Diesel, dual and Brayton cycles, Reversed heat engine cycle, Vapour compression refrigeration cycles. **(9)**

Course Outcomes:

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

1. Define the fundamentals of the zeroth and first laws of thermodynamics and explain their application to a wide range of systems.
2. Apply the properties of steam to design steam systems.
3. Apply the second law of thermodynamics for the design of heat engine, heat pump and refrigerators. The student will also be able to Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
4. Explain the cycles on which IC engines, Gas turbines and refrigerator works.
5. Explain the importance of Tds relations and be able to use psychometric charts for the design of air conditioning systems.

Text Books:

1. Cengel, Y.A and Boles, M.A, Thermodynamics: An Engineering Approach, 5th ed., McGraw-Hill, 2006.

References:

1. Sonntag, R.E., Borgnakke, C., and Van Wylen, G.J., Fundamentals of Thermodynamics, 6th ed., John Wiley, 2003.
2. Nag, P.K., Engineering Thermodynamics, 3rd ed., Tata McGraw-Hill, 2005.

Mode of Evaluation: Assignment, Mid Examination, End Examination

Open Elective - II

18EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

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
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.

(9)

UNIT II: RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS
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.

(8)

UNIT III: ILLUMINATION SYSTEMS
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.

(8)

UNIT IV: INDUSTRIAL SUBSTATION SYSTEMS
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. **(8)**

UNIT V: INDUSTRIAL SYSTEM AUTOMATION
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.

(12)

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:
1. Web site for IS Standards.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
3. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

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

Open Elective - II

18EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

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
Overview – History and industry perspectives – Working principles – Mechanics and dynamics –– Scaling law

(9)

UNIT II: MICRO SENSORS & ACTUATORS
Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems

(9)

UNIT III: MICRO MANUFACTURING
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.

(9)

UNIT IV: MODELING IN MEMS
Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

(9)

UNIT V: MEMS APPLICATIONS
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

(9)

Course Outcomes:

At the end of the course, students will 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

References:

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

18CSE301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To give introduction to shell programming.
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management

UNIT I: INTRODUCTION

Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. KORN SHELL PROGRAMMING:Basic Script Concepts,Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

(9)

UNIT II: PROCESS CONCEPTS

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

(9)

UNIT III: PROCESS SYNCHRONIZATION AND DEADLOCKS

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

(9)

UNIT IV: MEMORY MANAGEMENT STRATEGIES

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and

Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

(9)

UNIT V: FILE SYSTEM:

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

(9)

Course Outcomes:

At the completion of the course the students will be able to:

1. Write shell scripts using korn shell.
2. Create processes & threads and implement the various process scheduling techniques.
3. Analyse the concurrent processing and deadlock situations.
4. Design algorithmic solutions to solve memory management problems.
5. Implement the different types of file management techniques.

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

References:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

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

Open Elective - II

18CSE302 E-LEARNING TECHNOLOGIES

Course Prerequisite: Nil

L	T	P	C
3	0	0	3

Course Description:
The course provides a comprehensive understanding of the fundamental theory of E-learning and the Strategies of E-Learning .The relation between Models of E-Learning and Multi/Hyper Media for E-learning has been explained across various stages of learning techniques.

Course Objectives:
1. To enable the students to understand the concept of e-learning and integrating the technology.
2. To inculcate knowledge in planning the role of information technology in virtual classroom and university.
3. To make the students to understand the technology mediated communication and its applications.
4. To include knowledge in planning models of E-learning in in virtual classroom and university.
5. To make the students to understand the future of E-learning technology and its development.

UNIT I: CONCEPT OF E-LEARNING
Meaning, Evolution of E-Learning – Components of E-Learning – Virtual classroom: Teleconferencing, Audio and Video conferencing.

(9)

UNIT II: STRATEGIES OF E-LEARNING
Process of E-Learning: Knowledge Acquisition and Creation, Sharing of Knowledge, Utilization of Knowledge – E-Learning Instructional Grounds: Behaviourism, Cognitivism and Constructivism.

(9)

UNIT III: MODELS OF E-LEARNING
Role of Web-Based Instruction in Learning – Models of WBI: Instructional Design Model (ISD) & Hyper Media Design Model (HMD) – Computer Languages for Designing WBI – Future of E-Learning.

(9)

UNIT IV: MULTI/HYPER MEDIA FOR E-LEARNING
Concept, Meaning, Characteristics and Applications – Teaching Techniques through Multi/Hyper Media – Multimedia & Learning – Multimedia for Co-operative and Collaborative Learning Strategies – General Guidelines for Multi/Hyper Media Applications – Advantages & Disadvantages of Multi/Hyper Media.

(9)

UNIT V: FUTURE OF E-LEARNING TECHNOLOGY
21stCentury Education – Challenges of Distance Education – Electronic Media in Distance Education – Open Educational Resources / Open Learning – Internet in Distance Education – Virtual University System.E-Patashala, Indian Institutes Developing E-Content.

(9)

Course Outcomes:

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

1. Understand the concept of e-learning and integrating the technology.
2. Make the students to understand the technology mediated communication and its applications.
3. Understand the technology mediated communication and its applications.
4. Include knowledge in planning models of E-learning in in virtual classroom and university.
5. Make the students to understand the future of E-learning technology and its development.

Text Books:

1. Badrul Khan and Mohamed Ally(Edited), 2015, International Hand book of E-Learning:Volume-1 Theoretical Perspectives and Research, Routledge,.
2. Robyler , 2007, Integrating Educational Technology into Teaching, 4th Edition, Pearson Education India .
3. Richard Andrews and Caroline Heythornthwaite (Edited), 2007, The SAGE Hand Book of E-Learning Research, SAGE,Delhi.

References:

1. Bryn Holmes and John Gardiner, 2006,E-Learning Concepts and Practice, ,Pine Forge Press.
2. Y.R. Ramaiah , 2002,Distance Education and Open Learning, , Mittal Publications.
3. PradeepMandav, 2001, Visual Media Communication, Authorspress.
4. Michael D.Wiliams, Prentice Hall, 2000,Integrating Technology into Teaching and Learning: Concepts and Applications,.
5. Laura Parker Roerden, O'Reilly, 1997,Net Lessons: Web-based Projects for Your Classroom, Volume 1.
6. Paul F. Merrill, Allyn and Bacon, 1996,Computers in Education, 3rd Edition.
7. Joan Riedl, Allyn and Bacon, 1995,The Integrated Technology Classroom.

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

OPEN ELECTIVE – IV

Open Elective - IV

18ENG301 CREATIVE WRITING

L	T	P	C
3	0	0	3

Course Description: The course functions as a broad-based introduction to various forms of creative writing, such as short fiction, poetry and drama. Short story writing is geared towards creative writing so that students learn about character, dialogue, voice, style and description in fiction. The course provides them with the opportunity to delve deeper into the analysis of selected short fiction and to work on stories of their own. Students explore the genre of poetry in-depth through their own writing and that of published poets. The study of playwriting involves many of the same focuses as short story writing, such as dialogue, character and plot. Students also experiment with writing these genres. The class is usually comprised of technique and style discussions, reading assignments and writing exercises.

Course Objectives:
This course enables the students to –

1. familiarize with different forms of writing: poetry, scene writing, vignette and feature writing.
2. To encourage reading and acquainting, appreciating and responding to different genres of writing.

UNIT I: Introduction to creative writing and reading. Poetry, Short Story, Drama, Fiction, Non Fiction, Feature Writing, etc. **(9)**

UNIT II: Poetry, Scenario writing, feature and vignette writing. Haiku, Object Poem, List Poem, Visual Poem, Nature Poem. Scanning a poem and understanding its meaning. **(9)**

UNIT III: Writing a scene, finding sources from which to draw ideas to write scenes, creating an effective setting for a scene to take place; creating strong, believable characters in a scene **(9)**

UNIT IV: Learning how a scene can drive the plot of a story, how to effectively use point of view to enhance a scene, how to write interesting and useful dialogue, self-editing own writing. **(9)**

UNIT V: Writing a vignette, finding sources from which to draw ideas to write a vignette, organizing one's time and ideas to produce a longer piece of writing. **(9)**

Course Outcomes:

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

1. Develop skills in reading, writing, and editing various literary genres.
2. Obtain an awareness of the role of analysis to inform appreciation and understanding of poetry.
3. Demonstrate the ability to read and respond thoughtfully.
4. Develop plot of the story and sketch characters with relevant dialogues
5. Obtain effective writing skills such as good essays and projecting scholarly ideas.

Text Book:

1. Tondeur, Louise. 2017. How to Think Like a Writer: A Short Book for Creative Writing Students and Their Tutors. Louise Tondeur

Reference Books:

1. Middleton, Daniel. 2012. The 7 Points of Write: An Essential Guide to Mastering the Art of Storytelling, Developing Strong Characters, and Setting Memorable Scenes. 711 Press

2. Kumar, Amrita. 2017. Kissing the Demon: The Creative Writer's Handbook. Harper Collins
3. Mastering Creative Writing: A Writer's Guide by Dahveed Bar-Daniel (kindle book) published :12 April 2017

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective- IV

18HUM303 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

Course Description: The objective of this course is to inculcate in students the skills necessary to craft strategies and initiatives which can enable growth and sustainability in an entrepreneurial venture, to include the effective management of inventory, receivables, production, human resources, financial resources, and risk. Students will develop higher-level critical thinking skills, evidenced by analysis, evaluation, and synthesis.

Course Objectives: The course is intended to:

1. Explain the basic concepts of entrepreneurship and its role in Indian Economy;
2. Describe the SWOT analysis, promotional and financial aspects of entrepreneurship
3. Explain project planning and feasibility studies;
4. Make the students acquire knowledge about women entrepreneurship; and
5. Explain the rural entrepreneurship and role of NGOs and EDPs in India.

UNIT I: INTRODUCTION

Entrepreneurial competencies, attitudes, qualities, functions - Forms of Entrepreneurship - Types of ownership - sole trading, partnership and corporation – Role of Government in Entrepreneurship Development. **(9)**

UNIT II: PROMOTIONAL & FINANCIAL ASPECTS OF ENTREPRENEURSHIP

Idea generation– opportunities - SWOT Analysis - patents and trademarks, Intellectual Property Rights. Financial Aspects of the Entrepreneurship: Source of Capital, Debt capital, seed capital, venture capital - Informal Agencies in financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings. **(9)**

UNIT III: PROJECT PLANNING AND FEASIBILITY STUDIES

Concept of Project, Project Life Cycle -Project Planning, Feasibility Report – Project proposal & report preparation. Technical Feasibility and Economic Viability – sources of New Ideas.

(9)

UNIT IV: WOMEN ENTREPRENEURSHIP

Scope of entrepreneurship among women – Promotional effects – Institutional framework - Successful cases of women entrepreneurs. **(9)**

UNIT V: RURAL ENTREPRENEURSHIP AND EDPS

Role of NGO's– Organizing EDPs – Social Entrepreneurship – startups – Entrepreneurship development among target groups of society. **(9)**

Course Outcomes:

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

1. Understand the concepts of entrepreneurship and its role in Indian Economy;
2. Compare and apply sources of different promotional and financial aspects;
3. Understand and analyze the feasibility study in project planning;
4. Find the women entrepreneurship development in India; and
5. Assess the rural entrepreneurship and strengthen the role of NGOs and EDPs.

References:

1. Entrepreneurial Development, S. Chand and Company Limited, S.S. Khanka, New Delhi, 2009.
2. Fundamentals of Entrepreneurship, H. Nandan, PHI, First/e, New Delhi, 2009.
3. Entrepreneurship, 6/e, Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH,2009.
4. The Dynamics of Entrepreneurial Development and Management, Vasanth
5. Desai, Himalaya,2009
6. Entrepreneurship Management – text and cases, Bholanath Dutta, Excel Books, 2009
7. Entrepreneurship – New venture Creation, Holt, PHI, 2009

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective – IV

18MAT303 GRAPH THEORY

	L	T	P	C
Course Prerequisite: Modern Algebra, Linear algebra	**3**	**0**	**0**	**3**

Course Description:

Graph theory is the core content of Discrete Mathematics. This course introduces in an elementary way some basic knowledge and the primary methods in Graph Theory also it is important in regarding to find out the mathematical structures from graph theory in concrete examples.

Course Objectives

1. To understand the fundamental definitions and properties of graphs.
2. To know the concepts of trees and spanning trees.
3. To learn about the matching and factors, connectivity.
4. To study the concepts of coloring of graphs, Planer graphs.
5. To introduce about the edges and cycles.

UNIT I: FUNDAMENTAL CONCEPTS
Graphs, path, cycles and trails, vertex degree and counting, directed graphs **(9)**

UNIT II: TREES AND DISTANCE
Basic properties, spanning trees, optimization and trees. **(9)**

UNIT III: MATCHING AND CONNECTIVITY
Matching and covers, algorithm and applications, Cuts and Connectivity, k-connetced graphs. **(9)**

UNIT IV: COLOURING OF GRAPHS AND PLANER GRAPHS
Vertex coloring, structure of k-chromatic graphs, Euler's formula, characterization of planar graphs. **(9)**

UNIT V: EDGES AND CYCLES
Line graphs and edge coloring, Hamiltonian cycles, planarity, coloring and cycles. **(9)**

Text Book:

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India 2014.

References

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
2. Frank Harary, Graph Theory, Narosa.
3. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.

Course Outcomes:

At the completion of the course the students will be able to:

1. Understand the basic terminology of graphs.
2. Determine the number of trees and spanning trees in a graph.
3. Find the matching and connectivity in graphs.
4. Learn about the concepts of coloring of graphs and Planer graphs.
5. Determine the number of edges and cycles of a graph.

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Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective - IV

18MAT304 MATHEMATICAL MODELING AND NUMERICAL SIMULATION

L	T	P	C
3	0	0	3

Course Description:
This course introduces mathematical modeling and numerical simulation as tools for analyzing and solving real world problems. Here, data assimilation (DA) technique has been discussed to find the best estimate of the state by combining available information including model forecasts, observations and their respective errors. The accurate initial condition obtained by DA is used as input to numerical weather prediction (NWP) modules to improve the model forecast. Data visualization techniques allow engineering students to use their perception to better understanding of the implications of the data and their importance in many different fields.

Course Objectives:

1. To understand the overview of dynamic model system with dynamical and thermo-dynamical equations
2. To understand the basic concept and classification of partial differential equations and importance of initial and boundary value problem.
3. To introduce the development and use of modeling system in terms of scale and physical process.
4. To provide a conceptual and mathematical overview of the data assimilation.
5. To develop the skills for design and a comparative study between observed and modeled data.

UNIT I: BASIC CONSERVATION LAWS AND APPLICATIONS OF BASIC EQUATIONS

Total differentiation, Vectorial form of the momentum equation in rotating coordinates, Component equations in spherical coordinates, The continuity equation, The thermodynamic energy equation, Basic equations in isobaric coordinates, Balanced flow, Trajectories and streamlines, Thermal wind, Vertical motion **(9)**

UNIT II: NUMERICAL DISCRETIZATION OF EQUATIONS

Classification of partial differential equations (PDEs), Initial value problems, Finite difference method for space discretization, Boundary value problems: Heat, Wave and Laplace equations **(9)**

UNIT III: NUMERICAL MODELS AND PHYSICAL PROCESSES

Numerical models: Global, Regional, Mesoscale models, Parameterization of sub-grid scale physical processes: Planetary boundary layer, Moist microphysics physics, Cumulus convection, Radiation, Airsea interaction processes, and Land-surface processes, Overview of interactions and parameterizations of these processes **(9)**

UNIT IV: DATA ASSIMILATION

Data assimilation: Empirical analysis schemes, Objective analysis schemes, Variational data assimilation techniques (unsteady three dimensional); Forecast error covariance; Dynamical and physical balance in the initial conditions; Quality control of observations; Atmospheric predictability; Concepts of chaotic systems and ensemble forecasting. **(9)**

UNIT V: DATA ANALYSIS AND VISUALIZATION

Introduction of WRF model and its Applications; Analysis of simulated and observed data sets through Grid Analysis and Display System (GrADS), MATLAB, and Excel software. **(9)**

Course outcomes
At the end of the course students are able to

1. Understand overview of dynamic model system and solve a set of dynamical and thermo-dynamical equations governing the state of the atmosphere.
2. Find accurate results through simulations by using proper and suitable representation of dynamical processes
3. Gain the knowledge of how and where to use the mathematical models in regional, mesoscale and global scales and develop an understanding of the physical processes
4. Compute the best estimate of the state by statistically combining model forecasts, observations, and their respective errors by using data assimilation technique.
5. Prepare the data for visualization and compare the results with observations.

Text books:

1. An Introduction to Dynamic Meteorology, Fourth Edition, by James R. Holtan, Elsevier Academic Press
2. Atmospheric Modeling, Data Assimilation, and Predictability, by Eugenia Kalnay (Cambridge University Press, 2003)
3. A description of the advanced research WRF version 3. Tech. Note, by Skamarock, W.C (2008).

References:

1. Dynamics, Volume 101, Second Edition: Physical and Numerical Aspects. Academic Press

2. Mark Z Jacobson. Fundamentals of Atmospheric Modeling, Cambridge University Press

3. James C. McWilliams. Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press

4. Introduction to Grid Analysis and Display System (GrADS), by Guilherme Martins (2014), DOI:10.13140/RG.2.1.2594.2249.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

Open Elective - IV

18PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: 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
Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation. **(9)**

UNIT II: THIN FILM DEPOSITION TECHNIQUES
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. **(9)**

UNIT III: PROPERTIES OF THIN FILMS
Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films. **(9)**

UNIT IV: CHARACTERIZATION OF THIN FILMS
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). **(9)**

UNIT V: APPLICATIONS OF THIN FILMS

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors. **(9)**

Course Outcomes:

After a successfully completed course the 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.

References:

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. An introduction to physics and technology of thin films / *Alfred Wagendristel, Yuming Wang*, Singapore: World Scientific, c1994.
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 Test, End Semester Examinations

Open Elective – IV

18CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

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.

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

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. **(9)**

UNIT II: TYPES AND SYNTHESIS OF NANOSTRUCTURES

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). **(9)**

UNIT III: PROPERTIES OF NANOMATERIAL

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. **(9)**

UNIT IV: CHARACTERIZATION OF NANOMATERIALS

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). **(9)**

UNIT V: APPLICATIONS OF NANOMATERIALS

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. **(9)**

Course Outcomes:

Upon completion of this course the 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.

References:

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 Test, End Semester Examinations

Open Elective - IV

18CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite:

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**

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.

(9)

UNIT II: PROGRAMMING AND PLOTTING

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.

(9)

UNIT III: DATA TYPES AND HANDLING TECHNIQUES

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration. **(9)**

UNIT IV: COMPUTATIONAL MODELING AND SIMULATIONS

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO. **(9)**

UNIT V: CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project. **(9)**

Course Outcomes:
At the end of the course, the 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.

References:

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 Test, End Semester Examinations

Open Elective- IV

18CE304 GREEN BUILDING AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Course Prerequisites: 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

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing – Building regulations and bylaws - Traditional and Vernacular Architecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones.

(9)

UNIT-II: CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN

Introduction - various steps in Site planning - Plan form Building envelope Landform -Topography – vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

(9)

UNIT-III: THERMAL FLOW IN BUILDINGS

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. **(9)**

UNIT IV: GREEN BUILDING MATERIALS AND CONSTRUCTION

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques - Techniques for roof, wall and foundations. **(9)**

UNIT V: ECONOMY OF GREEN BUILDING
Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones. **(9)**

Course Outcomes:
1. An understanding on green building materials and construction techniques.
2. Knowledge on renewable energy and energy conservation through material usage.
3. A thorough understanding on designing green buildings

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.

References:

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, Charothar Publishing House

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course covers demand, quality, treatment and distribution of water along with characterization, collection, low cost treatment of waste water and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included.

Course Objectives

1. To explain water quality standards, treatment, distribution of drinking water
2. To analyze the characteristics of wastewater and discuss about various units of sewage treatment system.
3. To explain various impacts of air and various methods to control air pollution
4. To describe about solid waste generation, characterization, impacts and various management techniques
5. To discuss about generation and management of electronic waste.

UNIT I: WATER TREATMENT

Water- Sources of Water, quality issues, health impacts of contaminated drinking water, water quality requirement for different beneficial uses, water quality standards, water quality indices, water safety plans, Layout of water Supply systems, components of water supply system; Distribution system, working principle of various units of surface water treatment plant layout

(9)

UNIT II: SEWAGE TREATMENT

Quantity of Sewage, Sewage flow variations. Sewage pumping; Sewerage, Sewer appurtenances, Storm Water; sewage disposal standards, pollution due to improper disposal of sewage, wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage, zero liquid discharge **(9)**

UNIT III: URBAN AIR POLLUTION AND CONTROL TECHNIQUES

Air - Composition and properties of air, source and impacts of air pollution-on human, vegetation and strucutres, types of air pollutants various air pollution control laws, National Ambient Air Quality Standards, Air Quality Index, Air pollution meteorology and dispersion, Principles and working of various air pollution control equipment- gravity settling chamber, cyclone separators, fabric filters and electrostatic precipitators. **(9)**

UNIT IV: MUNICIPAL SOLID WASTE MANAGEMENT

Municipal Solid Waste-Characteristics and Quantities, MSW Rules, Municipal Solid Waste Collection, Transportation, Segregation and Processing, compositing, recycling, disposal- landfilling and incineration. **(9)**

UNIT V: ELECTRONIC WASTE MANAGEMENT

E-Waste Generation, E-Waste Rules, Techniques for Recycling and Recovery – glass, plastics, ferrous and non-ferrious materials **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain about impacts of drinking water contamination and various units of surface water treatment plant
2. Discuss about sewage generation and various methods of sewage treatment
3. Describe the impacts of air pollution and review various air control methods
4. Discuss about the impacts of solid waste and various solid waste management techniques
5. Explain the impacts and beneficial reuse of electronic waste

Text 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. Garg, S.K., Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008.
3. Rao M and Rao H.V.N. Air Pollution, McGraw Hill Education, 2017.
4. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009

Reference Books:

1. Punmia, B.C, Ashok K Jain, Arun K Jain., Waste Water Engineering, Laxmi Publications, 1998.
2. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
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 Test, End Semester Examinations

Open Elective- IV

18ME304 INTERNET OF MANUFACTURING THINGS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The manufacturing industries are the significant sustainable sources for the modern society. Traditional manufacturing systems and relative management approaches need constant review and upgrade to meet the demands of modern complex products. Internet of Things (IoT), has potential to collect, process, analyze and communicate real time data, while enhancing overall productivity within given time frame with higher flexibility and transparency. This course tries to provide the essential knowledge to bridge the IoT and Manufacturing systems.

Course Objectives:

1. To provide the basic knowledge and importance of IoT and its logic and applications in Manufacturing Industry.
2. To provide the basic knowledge of real time information sensing and cloud computing in manufacturing system.
3. To understand the concepts of IoT enabled smart trolleys and assembly systems.
4. To provide basic understanding of real-time production performance analysis methods. and scheduling system.
5. To provide basic understanding of real-time, information driven production scheduling system.

UNIT I:
Introduction- Concept of IoT, Existing manufacturing paradigms and their limitations, Applications of IoT in Manufacturing System (MS), The Concept of IoT-MS and its limitations. (9)

Overview of IoT-Enabled Manufacturing System- Overall architecture of IoT-MS, Integration framework of real-time manufacturing information, The work logic of IoT-MS, Core technologies in IoT-MS. **(9)**

UNIT II:

Real-Time(RT) Multisource Manufacturing Information Sensing System - Introduction, Overall Architecture of RT and multisource RMMISS, Deployment of multi-sensors, Multiple sensors manager, Multiple source manufacturing Information Capturing and Sharing, Case studies.

Cloud Computing-Based Manufacturing – Introduction, Overall architecture, Cloud Machine Model, MS-UDDI, Task driven manufacturing service method. **(9)**

UNIT III:
IoT-Enabled Smart Assembly Station- Introduction, RFID based applications and assistant services in assembly line, Overall architecture, Real-time: Status Monitoring, Production Guiding, Data Sharing, Production Requeuing.

IoT Enabled Smart Trolley– Material handling and real time strategy, RT-data capturing in manufacturing field, overall architecture, Real-time: Information capturing, Encapsulation, Exchange, Workflow based guidance. Two stage combination optimization method. **(9)**

UNIT IV:
Real-Time (RT) Production Performances Analysis Method- Real-time: Production monitoring technique, KPI analysis, Anomaly analysis. Overall architecture, Even hierarchy of critical event, HTCPN analysis. Real time production anomaly diagnosis. **(9)**

UNIT V:
Real-Time Information Driven Production Scheduling System – Introduction, RT production scheduling, Agent technology, Manufacturing information monitor technology, Overall architecture, Equipment agent, Capability evaluation agent model, RT- scheduling agent model, Production execution monitor agent model. **(9)**

Course Outcomes:
The focus of this course is to study the inculcation of IoT in manufacturing systems and how the system turns smart. By the end of the course student should:

1. Be able to understand the fundamentals of IoT and its application in manufacturing systems.

2. Have a clear overall picture of multisource manufacturing information sensing system and cloud manufacturing.

3. Outline various methods of IoT enabled smart assembly systems and summarize the usage of smart trolleys

4. Make use of various RT- production performance analysis methods for test its applicability to real life problems.

5. Make use of various RT- information driven production scheduling system for test its applicability to real life problems.

Text Book:

1. Fei Tao, Y. Zhang, “Optimization of Manufacturing Systems Using the Internet of Things”, 1st Edition, 2017, Academic Press, Elsevier.

Reference Book:

1. A. Gilchrist, “Industry 4.0: The Industry Internet of Things”, 1st Edition, 2016, Apress.
2. M. Dastbaz, P. Cochrane, “Industry 4.0 and Engineering for a Sustainable Future”, 1st Edition, 2019, Springer.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective- IV

18ME305 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. Gives the complete details to setup an enterprise which includes the generating the business ideas, writing a business plan 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
Introduction to Entrepreneurship 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. Case studies about successful Entrepreneur. **(9)**

UNIT II : CREATING AND STARTING THE VENTURE
Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities. Develop the business plan and evaluate with team. **(9)**

UNIT III: FINANCING AND MANAGING THE NEW VENTURE
Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce 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. **(9)**

UNIT IV: PLANT LAYOUT
Choosing location and layout, 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. **(9)**

UNIT V: MARKET ANALYSIS
Designing the workplace, 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.
(9)

Course Outcomes:
At the end of the course, students should be able to
1. Describes the sources of new business ideas, methods to develop new ideas and use the problem solving techniques
2. Able to Write a business plan which includes Financial plan, Organizational Plan and Marketing Plan
3. Able to identify the financial sources for new business ventures
4. Able to select a plant layout and draw a plant layout
5. Design a work place and Analyze the market research for new business.

Text Books:
1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

References:
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 Test, End Semester Examinations

Open Elective- IV

18ME306 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: 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. It helps to reduce costs, exceed needs and expectations of customers and other stakeholders of an organization. TQM encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership.

Course Objectives:

The students will be able to:

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. To be aware of international/national Quality awards.

UNIT I: INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran and Crosby – Dimensions of quality – Benefits of quality and Barriers. **(9)**

UNIT II: TQM PRINCIPLES

TQM principles - Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection, Supplier Rating. **(9)**

UNIT III: TOOLS AND TECHNQUES I

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 – FMEA. **(9)**

UNIT IV: TQM TECHNIQUES

Quality circles – Quality Function Deployment (QFD) – Design of Experiments-Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.
(9)

UNIT V: IMPELMENTATION OF TQM

Steps for Implementation of TQM, KAIZEN, 5S, JIT, POKAYOKE, I - Introduction to Robust Design, ISO Standards, Need for ISO 9000 and 14000 series, Quality Systems and Case studies.
(9)

Course Outcomes:

Upon successful completion of this course, the student 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 Book:

1. Dale H. BesterField, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

References:

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 Test, End Semester Examinations

Open Elective- IV

18EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Course Prerequisite: Control Systems

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 area for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:

1. To know the fundamentals of Robotics & its Applications.
2. To make students capable of handling robot manipulator tasks in real, as well as in simulation environment.
3. To know about kinetic and Jacobian modeling
4. To know about sensors and actuators.

UNIT I: INTRODUCTION & TRANSFORMATION AND MAPPING

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. **(9)**

UNIT II: KINEMATIC MODELS

Direct Kinematic Model- Mechanical Structure and Notations, Description of links and joints, Kinematic modelling of the Manipulator, Denavit - Hartenberg notation, Kinematic relationship between Adjacent Links, Manipulator Transformation Matrix. Inverse Kinematic Model- Manipulator workspace, Solvability of Inverse Kinematic model, Solution Techniques, Closed form solution. **(9)**

UNIT III: JACOBIAN AND DYNAMIC MODELLING

Differential motion and statics- Linear and Angular Velocity of a Rigid Body, Relationship between Transformation, Mapping Velocity Vector, Velocity propogation along links, Manipulator Jacobian, Jacobian Inverse, Jacobian Singularities, Static Analysis. Dynamic modelling- Lagrangian mechanics, Lagrange-Euler formulation, Newton-Euler formulation, Comparison of Langrange-Euler and Newton-Euler formulation, Inverse Dynamics**.** **(9)**

UNIT IV: ROBOT MANIPULATOR CONTROL AND PATH PLANNING (9)

Robot manipulator control- Introduction, Control of Puma Robot Arm, Computed Torque Technique, near minimum time control, Variable structure control, Non linear decoupled feedback control, Resolved motion control, Adaptive ControlPath/Trajectory Planning- Introduction, Joint space techniques, Cartesian space techniques, State space search, Problem reduction and use of predicate logic, Means-Ends analysis, Problem solving and robot learning, Robot Task Planning and Basic problems. **(9)**

UNIT V: SENSORS AND ACTUATORS

Range sensing, Proximity sensing, Touch sensors, Force and Torque sensing, Artificial Intelligence techniques using Neural Networks and Fuzzy control. **(9)**

Course Outcomes:

At the end of the course, students will able to

1. Understand the fundamentals of Robotics.
2. Analyze the mechanical structure and notations kinematic model.
3. Analyze the jacobian and dynamic modeling.
4. Explain the robot manipulator control and path planning.
5. Describe the various sensors and actuators.

Text Book:

1. Mittal, R.K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

References:

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., RobotSensors, Vision Vol.-I.Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill, 1986.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisite: BEE

Course Description:
To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:
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
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, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one line diagram- electrician's safety kit. **(9)**

UNIT II: GROUNDING AND BONDING
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.

(9)

UNIT III: SAFETY METHODS
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. **(9)**

UNIT IV: SAFETY TEAM
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. **(9)**

UNIT V: MAINTENANCE OF ELECTRICAL EQUIPMENT
Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- standard for electrical safety in work place- occupational safety and health administration standards.

(9)

Course Outcomes:
At the end of the course, students will able to
1. Describe electrical hazards and safety equipment.
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:

1. Dennis Neitzel, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education , 4th Edition,2012.

References:

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE304 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Java Programming and Basics of XML

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:
While studying this course student will be able 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
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 . **(9)**

UNIT- II USER INTERACTION
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**.** **(9)**

UNIT- III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES

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. **(9)**

UNIT IV: SAVING, RETRIEVING AND LOADING DATA:

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 **(9)**

UNIT-V APPLICATIONS WIDGETS, INTERACTION AND SENSORS

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

(9)

Course Outcomes:

Upon successful completion of this course, students can 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 Books:

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,ByZigurdMednieks,LairdDornin,G.BlakeMeike& Masumi Nakamura, O'Reilly

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE305 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

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:
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. Match organizational needs to the most effective software development model.
5. Create project plans that address real-world management challenges.

UNIT I SPM CONCEPTS
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. **(9)**

UNIT II SOFTWARE MEASUREMENTS
Monitoring & measurement of SW development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects. **(9)**

UNIT III SOFTWARE QUALITY
Quality in SW 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. **(9)**

UNIT IV RISK ISSUES
The risk issues in SW development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management. **(9)**

UNIT V SPM TOOLS
Software project management using Primavera & Redmine and case study on SPM tools .**(9)**

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 Books:

1. Richard H. Thayer, "Software Engineering Project Management", John Wiley & Sons, 2nd edition, 2001
2. Royce, Walker, "Software Project Management", Pearson Education, 2002
3. Kelker, S. A., "Software Project Management", Prentice Hall, 2003

References:

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, PankajJalote, Pearson Education.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

Open Elective – IV

18CSE306 SOFTWARE TESTING

L	T	P	C
3	0	0	3

Course Prerequisite: 20CSE112

Course Description:
This course aims to introduce the students to different methodologies in testing a program and its usage in building the testing tools. This course covers introduction to principles of software testing, path testing, transaction testing, dataflow testing, domain testing, path, path product, regular expressions with node reduction algorithm, functional testing, and logic based testing, state graph and its applications, graph matrices and its applications and case study of testing tools.

Course Objectives:
1. To study the Basic software debugging methods.
2. To enable the Students to understand various testing methodologies.
3. To study the procedure for designing test cases.
4. To enable the Students about the significance of software testing.

Unit I: Principles of Software Testing and Path Testing
Concepts and principles of software testing: Introduction: Purpose of Testing, Dichotomies, model for Testing, Consequences of Bugs, and taxonomy of Bugs. Structural Testing: Flow graphs and Path testing, Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing. **(9)**

Unit II: Transaction Flow Testing and Dataflow Testing
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.
(9)

Unit III: Domain Testing, Paths, Path Products and Regular Expressions
Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interface Testing, Domains and Testability Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.
(9)

Unit IV: Functional Testing, State, State Graphs and Transition Testing
Functional Testing: Logic Predicates and Clauses, Logic Based Testing, Logic Expression Coverage Criteria, Active Clause Coverage, Inactive Clause Coverage, Infeasibility and Subsumption, Making a Clause Determine a Predicate, Structural Logic Coverage of Programs, Decision Tables, Path Expressions, KV Charts, and Specifications. State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips.
(9)

Unit V: Applications of Test Case Design

TestingObject-Oriented Software, Unique Issues with Testing OO Software, Types of Object-Oriented Faults , Testing Web Applications and Web Services, Testing Static Hyper Text Web Sites, Testing Dynamic Web Applications, Testing Web Services, symbolic testing, Concolic testing, Conclusions. **(9)**

Course Outcomes:

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

1. Understand the basic principles of testing, path testing and compare different path testing strategies.

2. Explain different transaction flow and data flow testing techniques.

3. Understand and identify various Domains testing strategies, methods and defining the method to find the regular expression used to find the testing paths.

4. Test the functions and state of the applications manually and by automation using different testing methods.

5. Apply and use software testing methods and various test tools.

Text Books:

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.

2. Software Testing- Yogesh Singh, Camebridge.

3. Introduction to Software Testing, Paul Ammann and Jeff Offutt, Cambridge University Press, 2nd edition, 2016.

References:

1. The craft of software testing - Brian Marick, Pearson Education.

2. Software Testing, 3rd edition,P.C. Jorgensen, Aurbach Publications (Dist.by SPD).

3. Software Testing, N.Chauhan, Oxford University Press.

4. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.

6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

DISCIPLINE ELECTIVE-I

Discipline Elective – I

18ECE401 NANO ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE112, 18ECE103

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

5. Apply the knowledge of Quantum physics to illustrate energy band structure.
6. Understand the basic physics of Kronig-Penney Model.
7. Understand the fundamentals of operation of the semiconductor electronic devices and their characteristics.
8. Understand the band theory of solids and concept of scaling.
9. Understand the features of nanomaterials for electronics device applications

UNIT I: INTRODUCTION
Introduction to nanotechnology, meso-structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. **(9)**

UNIT II: BAND THEORY
Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones. **(9)**

UNIT III: SHRINK-DOWN APPROACHES
Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.). **(9)**

UNIT IV: NANO DIODES
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics. **(9)**

UNIT V: APPLICATIONS
Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation. **(9)**

Course Outcomes:

Upon completion of this course the students should 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 Books

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

Reference Books

1. K.E. Drexler, Nanosystems, 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.

Discipline Elective – I

18ECE402 PATTERN RECOGNITION AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE104, 18MAT109

Course Description:
This course describes the concepts of classification of objects through supervised and unsupervised techniques. These objects can be speech signal and wavelet waveforms (1D signals) or can be an image (2D signal) that need to be classified. The course includes the clustering concept, Stochastic grammars and applications, structural pattern recognition and feature extraction which are the integral part of machine intelligence systems.

Course Objectives
This course enables students to
1. Study the fundamental algorithms for pattern recognition.
2. Instigate the various classification techniques.
3. Originate the various structural pattern recognition and feature extraction techniques

UNIT I: INTRODUCTION
Overview of pattern recognition – Feature extraction and Pattern Representation - Concept of Supervised and Unsupervised classification - Introduction to Application Areas. **(9)**

UNIT II: UNSUPERVISED CLASSIFICATION
Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions. **(9)**

UNIT III: STRUCTURAL PATTERN RECOGNITION
Elements of formal grammars - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation. **(9)**

UNIT IV: FEATURE EXTRACTION AND SELECTION
Feature Selection- Outlier Removal - Data Normalization - Missing Data - Entropy minimization – Karhunen- Loeve transformation - Feature selection through functions approximation - Binary feature selection. **(9)**

UNIT V: AN APPLICATION: HANDWRITTEN DIGIT RECOGNITION
Description of the Digit Data - Pre-processing of Data - Classification Algorithms Recent Advances Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case study using Fuzzy Pattern Classifiers and Perception. **(9)**

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 recent advance algorithms.

Text Books

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", JohnWiley& Sons, 2001.
2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and ImageAnalysis", Prentice Hall, 1999.
3. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.

Reference Books

1. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
2. Duda R.O., and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
3. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
4. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.

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

Discipline Elective – I

18ECE403 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE103, 18ECE105

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
Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases. **(9)**

UNIT II: BIO-ELECTRODES AND AMPLIFIERS
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. **(9)**

UNIT III: BIOMEDICAL MEASURING INSTRUMENTS
Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography. **(9)**

UNIT IV: MEDICAL IMAGING
X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging. **(9)**

UNIT V: PROSTHESES AND AIDS
Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects. (**9)**

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 Books

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, "Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw-Hill, New Delhi, 2005.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice-Hall, New Delhi, 2011.

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

Discipline Elective – I

18ECE404 ELECTRONIC PACKAGING AND TESTING

Course Prerequisite: 18ECE103

L	T	P	C
3	0	0	3

Course Description:

This course gives the fundamental overview of electronic systems packaging, issues in packaging, chip packages, surface mount technology and thermal effect.

Course Objective:

This course enables students to

1. Know the basic concepts and applications of Electronic Systems Packaging
2. Understand the electrical issues in electronic packaging
3. Study and test the electronic PCB boards
4. Know the surface mount technology and their thermal consideration
5. Develop system level electrical testing

UNIT I: OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrate. **(9)**

UNIT II: ELECTRICAL ISSUES IN PACKAGING

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. **(9)**

UNIT III: CHIP PACKAGES

IC Assembly - Purpose, Requirements, Technologies, 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 **(9)**

UNIT IV: PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS

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. **(9)**

UNIT V: TESTING

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

(9**)**

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 PCB boards
4. Understand the surface mount technology and their thermal consideration
5. Develop system level electrical testing

Text Books

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.

Discipline Elective – I

18ECE405 NETWORKS AND TRANSMISSION LINES

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course provides the fundamental aspects of networks and transmission lines, which include the designing of different types of network filters and analysis of impedance matching in transmission lines. This course incorporates study of different types of attenuators, equalizers and discusses the losses associated in different transmission lines.

Course Objectives:
This course enables students to

1. Understand the fundamental concepts of the networks and its impedance.
2. Prepare students for designing of different types of network filters.
3. Study different types of attenuators and equalizers for measuring and controlling the losses in networks.
4. Study the various types of transmission lines, their characteristic impedance and various losses associated with them.
5. Give thorough understanding about impedance transformation and matching by use of transmission line sections.

UNIT I: NETWORKS
Network elements, Network function, Driving point and transfer impedances and their properties, Image and Iterative impedances, Insertion loss and Attenuation and pads, Lattice network and its parameters, Impedance matching networks. **(9)**

UNIT II: NETWORKS FILTERS
Filter fundamentals, Classification of Filters, Design of Filters: low pass, high pass, band pass and band elimination filters, constant K and m-derived sections, composite filters. **(9)**

UNIT III: Attenuators and Equalizers
Attenuator: T-Type, Pi-Type, Bridged T-Type, Lattice Type and L-Type Attenuators. **Equalizers**: Inverse impedances. Series and Shunt equalizers, T-equalizers and Bridged T-equalizers, Lattice equalizers. **(9)**

UNIT IV: TRANSMISSION LINE THEORY
General theory of Transmission lines and solution, The infinite line and wavelength, Physical interpretation of voltage and current solutions, Primary & Secondary constants, Phase & Group velocities, Transmission line equations, Characteristics of LF Transmission lines, Loading and different methods of loading. **(9)**

UNIT V: TRANSMISSION LINE AT RF

RF Transmission lines, Voltage Standing Wave Ratio (VSWR), lossless lines, Return Loss & Reflection co-efficient, Input and transfer impedance, Reflection factor and reflection loss. Smith chart, Impedance matching with single and double stub Impedance matching using Smith chart.

(9)

Course Outcomes:

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

1. Understand the networks and Transmission lines used in many applications (such as communication systems).
2. Implement various types of networks filters in conjunction with Transmission lines.
3. Evaluate the losses of networks by using different attenuators and equalizers
4. Analyze characteristic parameters and various losses associated with Transmission lines.
5. Use Smith chart and design transmission line sections for realizing reactive impedance.

Text Books

1. John. D. Ryder, “Network lines and fields”, 2nd edition, PHI Learning, 2005.
2. Walter Curtis Johnson, “Transmission Lines and Networks”, Mc-Graw Hill, 1950.

Reference Books

1. Umesh Sinha, “Transmission lines and Networks”, Sathya Prakasham Publishers, 1997.
2. M.E. Van Valkenburg, “Network Analysis”, 3rd edition, PHI, 2008.
3. David K. Cheng, “Field and Wave Electro magnetics”, Pearson Education Inc, Delhi, 2004.

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

DISCIPLINE ELECTIVE-III

Discipline Elective – III

18ECE406 FIBER OPTIC COMMUNICATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE107

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, 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

4. Expose the students about the fundamental of optical communication
5. Introduce the advanced features of Transmitters, Receivers, Switches and Amplifiers
6. Enable the students to understand various dispersion compensation techniques and non-linear effects in optical fiber.

UNIT I: INTRODUCTION TO OPTICS
Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR. **(9)**

UNIT II: OPTICAL TRANSMITTERS AND RECEIVERS
Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties. **(9)**

UNIT III: OPTICAL SWITCHES AND AMPLIFIERS
Optical switches - coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier. **(9)**

UNIT IV: WDM AND DWDM NETWORKS
WDM systems. Principles of WDM networks, WDM Light wave Systems - WDM Components - System Performance Issues - Time-Division Multiplexing - Subcarrier Multiplexing - Code-Division Multiplexing, DWDM systems. **(9)**

UNIT V: NON- LINEAR EFFECTS

Nonlinear effects in fiber optic links. Concept of self-phase modulation, cross-phase modulation, four wave mixing, Raman and Brillouin scattering, group velocity dispersion and solution based communication. **(9)**

Course Outcomes:

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

1. Acquire the knowledge on the 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 TDM, FDM, WDM and DWDM light wave systems.
5. Analyze the nonlinear effects in optical fiber and understand their mechanism relevant to WDM systems.

Text Books

1. G.P. Agarwal, Fiber optic communication systems, 4nd Ed, John Wiley & Sons, New York, 2010.
2. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
3. Franz & Jain, Optical Communication Systems, Narosa Publications, New Delhi, 1995.

Reference Books

1. G. Keiser, Optical fiber communication systems, McGraw-Hill, New York, 2000.
2. Franz & Jain, Optical communication, Systems and components, Narosa Publications, New Delhi, 2000.
3. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
4. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
5. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
6. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.

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

Discipline Elective – III

18ECE407 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE106

Course Description:
This course illustrates the concept of embedded system design inculcating all the hardware as well as software aspects of it. It also incorporates the design of the embedded system using

Course Objectives:
This course enables students to

1. Prepare the students about the tools and techniques used in the design of embedded system.
2. Understand the architecture, instruction set and programming aspects of 8051 microcontroller.
3. Understand the architecture, instruction set and programming aspects of ARM Processor.
4. Understand the basics of operating systems and then to learn the related terms of real time operating systems and related terms.
5. Understand the interfacing of different analog and digital blocks concerned to embedded systems.

UNIT I: THE CONCEPT OF EMBEDDED SYSTEMS
Embedded System Design, Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories. Embedded microcontroller cores, like 8051 Microcontroller-Architecture, Assembly Language Programming with 8051. Embedded C vs Assembly language.
(9)

UNIT II: TECHNOLOGICAL ASPECTS OF EMBEDDED SYSTEMS
Interfacing between analog and digital blocks, signal conditioning, digital signal processing. Sub-system interfacing, interfacing with external systems, like, user interfacing, Design tradeoffs due to process compatibility, thermal considerations, etc. **(9)**

UNIT III: SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I
Operating System Basics, operating systems for embedded systems, types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking. Real time programming languages e.g. Embedded C, ARM Assembly Programming. **(9)**

UNIT IV: SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II
Task Scheduling. Task Communication, Task Synchronization Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.
(9)

UNIT V: ADVANCED MICROCONTROLLERS

ARM Design Philosophy, ARM Architecture (LPC 2148) and Organization, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, ARM/ Thumb Instruction set.

(9)

Course Outcomes:

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

1. Understand the concept of embedded system design and study the core embedded system component, the microcontroller, using 8051.
2. Develop knowhow about the technological aspects of embedded systems, including interfacing and design trade-offs.
3. Conceptualize the software aspects of embedded system design by understanding real time operating systems, programming languages.
4. Design of real-time task approach using real-time operating system to be implement on Real-time controllers with data handling / processing systems.
5. Understand the design philosophy of ARM processors and its applications to the embedded system design.

Text Books

1. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.
2. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.

Reference Books

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. J. E. Cooling "Real-Time Operating Systems: Book 1 - the Theory, Book 1" the Engineering of Real-Time Embedded Systems Series Independently Published, 2017.
3. Steve Furber "Arm System-on-chip Architecture 2nd Edition 2nd Edition" Pearson, 2015.

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

Discipline Elective – III

18ECE408 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE107

Course Description:
The course goals are to introduce the principles and applications of information theory. The course will cover how information is measured in terms of probability and entropy, and the relationships among conditional and joint entropies; how these are used to calculate the capacity of a communication channel, with and without noise; coding schemes, including error correcting codes; how discrete channels and measures of information generalize to their continuous forms. This course also covers Lloyd-Max Quantizer and vector quantization.

Course Objectives:
This course enables students to

1. Calculate the information content of a random variable from its probability distribution.
2. Relate the joint, conditional, and marginal entropies of variables in terms of their coupled probabilities.
3. Define channel capacities and properties using Shannon's Theorems.
4. Construct efficient codes for data on imperfect communication channels.
5. Generalize the discrete concepts to continuous signals on continuous channels.

UNIT I: REVIEW OF PROBABILITY THEORY
Concepts of randomness, redundancy, compressibility, noise, bandwidth, and uncertainty in relation to information, Ensembles, random variables, marginal and conditional probabilities, metrics of information. **(9)**

UNIT II: ENTROPY AND MUTUAL INFORMATION
Marginal entropy, joint entropy, conditional entropy, and the Chain Rule for entropy, Mutual information between ensembles of random variables. **(9)**

UNIT III: SOURCE CODING THEOREM, VARIABLE AND FIXED-LENGTH CODES, CHANNEL TYPES AND CHANNEL CAPACITY
Markov sources, Shannon's noisy coding theorem and converse for discrete channels, The binary symmetric channel, Capacity of a noiseless discrete channel, Perfect communication through a noisy

channel, Capacity of a discrete channel as the maximum of its mutual information over all possible input distributions. Error correcting codes, Application to continuous channels. **(9)**

UNIT IV: RATE-DISTORTION THEORY

Definition and Properties of Rate-Distortion Functions, Calculation of Rate-Distortion Functions, Computational Approach for Calculation of Rate-Distortion Functions. **(9)**

UNIT V: QUANTIZATION

Introduction to Quantization, Lloyd-Max Quantizer, Companded Quantization, Variable Length Coding and Problem Solving in Quantizer Design, Vector Quantization. **(9)**

Course Outcomes:

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

1. Apply information theory and linear algebra in source coding and channel coding
2. Understand the concept of probability theory and its applications to information processing.
3. Understand various error control encoding and decoding techniques
4. Understand the concept of information and entropy
5. Understand Shannon's theorem for coding, Shannon's noisy coding theorem and Markov Sources.

Text Books

1. Ranjan Bose, "Information Theory, Coding and Cryptography", Tata McGraw-Hill, Second Edition, 2002.
2. P. S. Satyanarayana, "Concepts of Information Theory and Coding", Dynaram Publication, 2005.

Reference Books

1. Richard B. Wells, "Applied Coding and Information Theory for Engineers", Pearson Education, LPE, First Indian Reprint, 2004.
2. Richard E. Blahut, "Algebraic Codes for Data Transmission", Cambridge University Press, 2003.
3. Shu Lin and Daniel J. Costello, "Error Control Coding – Fundamentals and Applications", Second Edition, 2004.
4. Thomas M Cover and Joy A Thomas, "Elements of Information Theory" MGH 2006.

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

Discipline Elective – III

18ECE409 FPGA BASED SYSTEM DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE102

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 FPGAbased 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. Learn the FOGA architectures.
3. Know Automated design flows supporting designs with FPGAs.
4. Understand the fundamentals of the FPGA design tools.

UNIT I: DESIGN WITH FPGA
Digital IC design flow- The role of FPGAs in digital design – Goals and techniques – Hierarchical design-CAD Tools. **(9)**

UNIT II: FPGA ARCHITECTURES
FPGA architectures – Configurable logic blocks - configurable I/O blocks – Programmable interconnect – clock circuitry – Xilinx FPGA architecture – Programming Technologies: Antifuse, SRAM, EPROM, EEPROM. **(9)**

UNIT III: VERILOG HDL
HDL overview - Modules and ports - compiler directives - data types - operands and operators - gate level modeling - data flow modeling - behavioral modeling - structural modeling – primitives-Tasks and functions - Writing test bench. **(9)**

UNIT IV: DIGITAL SYSTEM DESIGN
Data path, control path -The ASM chart, Arithmetic and logic unit, Shifter, Multiplier –Memory unit Building a Data path, ALU control, pipelined data path and design of main control unit. **(9)**

UNIT V: LOGIC IMPLEMENTATION FOR FPGAS

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. **(9)**

Course Outcomes:

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

1. Understand 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. Understand the concepts of back end design in FPGA platform.

Text Books

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.

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. David A Patterson and John L Hennessey, "Computer Organization &Design - The Hardware / Software Interface", Harcourt Asia Pvt. Ltd., Morgan Kaufmann,2011.
6. 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.

Discipline Elective – III

18ECE410 DSP ARCHITECTURES

Course Prerequisite: 18ECE110

L	T	P	C
3	0	0	3

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
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. **(9)**

UNIT II: STRUCTURAL AND ARCHITECTURAL CONSIDERATIONS
Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

(9)

UNIT III: VLIW ARCHITECTURE

Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, 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. **(9)**

UNIT IV: FPGA BASED DSP SYSTEMS

Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor. **(9)**

UNIT V: HIGH PERFORMANCE COMPUTING USING P-DSP

Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure. **(9)**

Course Outcomes:

Upon successful completion of the course, 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 Books

1. B Venkataramani and M Bhaskar, “Digital Signal Processors”, TMH, 2002.
2. E.S.Gopi, “Algorithmic Collections for Digital Signal Processing Applications using MATLAB”, 1st Edition, Springer Netherlands, 2007.

Reference Books

1. Digital Signal Processing: A practical approach, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. Peter Pirsch, “Architectures for Digital Signal Processing”, John Weily, 2007.

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

DISCIPLINE ELECTIVE-IV

Discipline Elective IV

18ECE411 ANTENNAS AND PROPAGATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE112

Course Description:
This course introduces the underlying principles of working of Antennas and its propagation. It starts with the fundamental concepts, radiation patterns with wires and loops. It inculcates the aperture and reflector antennas, broadband antennas, micro strip antennas. It also describes the basic concepts of smart antennas and different modes of communication used in modern times.

Course Objectives:
This course enables students to
1. Understand the fundamental principles of antenna in the context of dipoles.
2. Classify the antennas as aperture and reflector antennas.
3. Classify the broadband and microstrip antennas.
4. Understand the concept of antennas arrays.
5. Analyze different modes of radio wave propagation and measurements.

UNIT I: INTRODUCTION
Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

RADIATION
Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop. **(12)**

UNIT II: APERTURE AND REFLECTOR ANTENNAS
Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. **(7)**

UNIT III: BROADBAND ANTENNAS
Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. **(7)**

UNIT IV: ANTENNA ARRAYS

Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkun off polynomial method, Woodward-Lawson method. Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice. **(7)**

UNIT V: WAVE PROPAGATION AND MEASUREMENTS

WAVE PROPAGATION:

Introduction, Ground Wave Propagation (Qualitative Treatment) –Plane Earth Reflections, Curved Earth Reflections. Space Wave Propagation –Field Strength Variation with Distance and Height, Effect of Earth‘s Curvature, Absorption, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Relation between MUF and Skip Distance, Multihop Propagation.

ANTENNA MEASUREMENTS:

Basic concepts, Near and Far Field, reflections, measurement ranges, elevated rages, ground- reflection ranges, polarization, impedance, efficiency, current distribution. **(12)**

Course Outcomes:

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

1. Understand the basic terminologies of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Understand the characteristics of broadband and microstrip antennas.
4. Apply the concept of smart antennas arrays.
5. Understand the antenna measurements and different types of wave propagation.

Text Books

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

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

Reference Books

1. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill,4th edition, 2007.

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

3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

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

5. Ahmed EL Zooghby, Smart Antenna Engineering, Artech House, 2005.

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

Discipline Elective IV

18ECE412 ASIC AND FPGA DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE113

Course Description:
This subject gives the insight idea of Application Specific integrated circuits and Field programmable logic devices. It also gives the ASIC physical design, logic synthesis, simulation and planning of VLSI circuits.

Course Objectives:
This course enables students to
1. Study the design flow of different types of ASIC.
2. Gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC.
3. Familiarize the different types of programming technologies and logic devices.
4. Learn the architecture of different types of FPGA.
5. Understand the design and testing methodologies of SOC design.

UNIT I: OVERVIEW OF ASIC AND PLD
Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs. **(9)**

UNIT II: ASIC PHYSICAL DESIGN
System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction – DRC **(9)**

UNIT III: LOGIC SYNTHESIS, SIMULATION AND TESTING
Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation. **(9)**

UNIT IV: FPGA
Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA’s FLEX 8000/10000, ACTEL’s ACT-1,2,3 and their speed performance. **(9)**

UNIT V: SOC DESIGN

Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC – Hardware / Software co-design Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB. **(9)**

Course Outcomes:

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

1. Understand the design flow of different types of ASIC.
2. Understand the knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC.
3. Apply different types of programming technologies and logic devices.
4. Understand architecture of different types of FPGA.
5. Understand the SOC design, testing methodologies.

Text Books

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997
2. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.

Reference Books

1. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications 1995.
2. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
3. Parag.K.Lala, Digital System Design using Programmable Logic Devices, BSP, 2003.
4. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.

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

Discipline Elective IV

18ECE413 WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE109

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. Study the evolution of wireless communication and cellular concepts
2. Study the characteristic of wireless fading channel, Equalization and Diversity.
3. Study the performance of various wireless fading channel.
4. Understanding the MIMO wireless system and OFDM technique.
5. Study of various emerging wireless Technology.

UNIT I: EVOLUTION OF WIRELESS COMMUNICATION AND CELLULAR CONCEPTS:
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. **(9)**

UNIT II: CHARACTERISTICS OF WIRELESS CHANNEL, EQUALIZATION AND DIVERSITY
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. **(9)**

UNIT III: PERFORMANCE ANALYSIS OF WIRELESS FADING CHANNEL
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. **(9)**

UNIT IV: MIMO WIRELESS SYSTEM
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, Basic concept of OFDM techniques. **(9)**

UNIT V: WIRELESS TECHNOLOGY
Introduction to Bluetooth, Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc-Network, Wireless Local Area network (WLAN) standards, IEEE-802.11, and Personal Area Networks. **(9)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand 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. Understand MIMO and OFDM techniques to improve system performance.
5. Understand the emerging trends in the field of Wireless Technology.

Text Books

1. Rappaport, T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
2. William Stallings., "Wireless Communication and Networks", Second Edition, Pearson Education, 2005.

Reference Books

1. Andrea Goldsmith, ‘‘Wireless communications", Second Edition, Cambridge University Press, 2005.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
3. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
4. Upena Dalal, "Wireless Communication", Oxford University Press, 2009.
5. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.

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

Discipline Elective IV

18ECE414 SOFTWARE FOR EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE107

Course Description:
This course provides students to an introduction 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. Study the Embedded Systems Overview and Design.
2. Study the Systems design methodology and Modelling.
3. Introduce Synthesis Software and Hardware.
4. Develop skill in Real Time Systems and Design Approaches.
5. Introduce Rapid Object -Oriented Process for Embedded System, UML, and RTUML Profile.

UNIT I: EMBEDDED SYSTEMS OVERVIEW AND DESIGN
Introduction, Custom single-purpose processors: Hardware - General-purpose processors: Software-Standard single-purpose processors: Peripherals - Memory Interfacing - Digital Camera Example. **(9)**

UNIT II: SYSTEM DESIGN METHODOLOGIES AND MODELLING
System Design methodologies: Bottom -Up, Top-Down, Middle, Platform, FPGA Architecture, Processor Synthesis, State-Based Models, Finite State Machines Modelling Programming languages. **(9)**

UNIT III: SYNTHESIS OVERVIEW SOFTWARE SYNTHESIS AND HARDWARE SYNTHESIS
Synthesis Overview, Target Language for Embedded System, Software Synthesis Flow, Code Generation, System-C, Multi-Task Synthesis, and Hardware Synthesis design flow, RTL diagram with FSM controller, HDL (VHDL/Verilog) Specification. **(9)**

UNIT IV: REAL TIME SYSTEMS AND DESIGN APPROACHES
Introduction RTOS, Design of RTOS, Periodic, Aperiodic and Sporadic Tasks, Precedence constraints and dependencies, Scheduling, Hard Real-Time Scheduling, Saving Memory Space & Powers, Task

and their states, Semaphores & shared Data, Message Queues, Mailboxes and Pipes, Events. **(9)**

UNIT V: RAPID OBJECT-ORIENTED PROCESS AND UML FOR EMBEDDED SYSTEMS
The Rapid Object -Oriented Process for Embedded System, Introduction about UML, RT UML Profile, UML Profile for Schedulability, Performance, and Design Methodologies of UML. **(9)**

Course Outcomes:

Upon completion of this course students should be able to:

1. Understand embedded systems and designs.
2. Understand design methodologies and modelling, FPGA architecture and programming languages.
3. Able to write embedded software with software and hardware.
4. Analyze real time systems and design approaches.
5. Describe tools for embedded systems.

Text Books

1. Douglass Bruce Powel," Real-Time UML", Pearson Education, 3rd Edition, 2004.
2. Simon, David E. "An embedded software primer." Addison-Wesley Professional, 1999.

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.

Discipline Elective IV

18ECE415 SPEECH AND AUDIO PROCESSING

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE104, 18ECE110

Course Description:
This course provides fundamental ideas of speech production and modeling, 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 modeling
2. Describe the linear prediction of speech.
3. Distinguish the types of speech quantization.
4. Solve problems on Scalar Quantization of LPC.
5. Describe the CELP in speech.

UNIT I: INTRODUCTION
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. **(9)**

UNIT II: LINEAR PREDICTION OF SPEECH
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. **(9)**

UNIT III: SPEECH QUANTIZATION
Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. **(9)**

UNIT IV: SCALAR QUANTIZATION OF LPC
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. **(9)**

UNIT V: CODE EXCITED LINEAR PREDICTION

CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards. **(9)**

Course Outcomes:

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

1. Develop the knowledge of Speech Production modeling 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. Describes the CELP in speech.

Text Books

1. A.M.Kondoz, "Digital Speech", Wiley Students Edition, Second Edition, 2004.
2. W.C. Chu, "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", Wiley Inter Science, 2003.

Reference Books

1. Reddy, "Biomedical Signal Processing: Principles and Techniques", Tata McGraw Hill, Second edition, 2005.

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

DISCIPLINE ELECTIVE-V

Dept. of Electronics and Communication Engineering

Discipline Elective – V

18ECE416 DIGITAL IMAGE AND VIDEO PROCESSING

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE110

Course Description:
This course provides the fundamental knowledge on processing images and videos and their application areas. In this course, different image processing operations such as enhancement, filtering, coding and segmentation are presented. In addition, it includes different video processing operations such as video coding and segmentation.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on fundamentals of digital images and digital videos.
2. Learn about image enhancement in spatial domain, image filtering and color image processing.
3. Understand various image segmentation and image coding schemes.
4. Analyse various types of video coding techniques.
5. Learn about video segmentation and object detection and tracking in videos.

UNIT I: DIGITAL IMAGE AND VIDEO FUNDAMENTALS
Image Processing Fundamentals -- Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.
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 **(9)**

UNIT II: IMAGE ENHANCEMENT, FILTERING AND COLOR IMAGE PROCESSING
Image Enhancements and Filtering
Gray level transformations, histogram equalization, 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. **(9)**
.
UNIT III: IMAGE CODING AND SEGMENTATION
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. **(9)**

UNIT IV: VIDEO CODING

Inter-Frame Redundancy, Motion Estimation Techniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – Group of pictures, frames, slices, macro-blocks and blocks - Elements of a video encoder and decoder - Video coding standards – MPEG and H.26X. **(9)**

UNIT V: VIDEO SEGMENTATION

Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts- spatial segmentation – Video object detection and tracking. **(9)**

Course Outcomes:

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

1. Apply mathematics to represent the connectivity and neighborhood relationship between pixels and frames.
2. Understand application-based image enhancement and color image processing.
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 Books

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. Murat Tekalp, Digital Video Processing, Prentice Hall, 2nd edition, 2015.

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

Discipline Elective – V

18ECE417 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE109

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. Understand the basic concept in the field of Satellite Communication and to know how to place a satellite in an orbit.
2. Calculate the link power budget.
3. Get a complete knowledge about the earth and space subsystems
4. Gain knowledge about the Satellite Access schemes
5. Gain knowledge about the Satellite system and mobile services provided

UNIT I: INTRODUCTION AND OVERVIEW OF SATELLITE

Historical background, Wireless communication and benefit, Overview of satellite communications, Orbits- Two body problem, orbital mechanics, Orbital equations, orbit determination, orbital & spacecraft problems geostationary orbit, change in longitude, orbital perturbations, Useful orbits for satellite communications, orbital effects in communication systems performance.

(9)

UNIT II: COMMUNICATION ANTENNA, SATELLITE SUBSYSTEMS AND BASIC TRANSMISSION THEORY

Basic concept of Wireless antenna, Mobile communication related with satellite communication, satellite antenna equipment reliability and space qualification. Satellite Subsystems: Telemetry, Tracking, command and monitoring, power systems, communication subsystems, Basic transmission theory, EIRP, system noise temperature and G/T ratio, 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.

(9)

UNIT III: MODULATION, MULTIPLEXING, MULTIPLE ACCESS TECHNIQUES AND TRANSMISSION Theory
Modulation technique, Amplitude Modulation(AM), Frequency Modulation (FM), FM transmission by satellite, Digital Transmission, Digital Modulation and Demodulation, Bit and symbol error rates BPSK, QPSK, Digital transmission of analog signals, Multiple access- FDMA, TDMA, CDMA techniques, comparison of multiple access techniques, error connecting codes.
(9)

UNIT IV: COMMERCIAL SATELLITE SYSTEMS AND VSAT SYSTEMS
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. **(9)**

UNIT V: NON-GEOSTATIONARY SATELLITE ORBIT (NGSO) SYSTEMS AND GPS
Non-Geostationary Satellite Orbit (NGSO) Systems: The third-generation satellite communication NGSO 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. **(9)**

Course Outcomes:
On successful completion of this course, you 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.

Text Rooks
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 McGraw Hill Education,2010
2. G. Maral and M. Bousquet, “Satellite Communications Systems—Systems, Techniques and Technology” John Wiley & Sons, 5thedition, 2009.
3. Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, “Satellite communications Engineering”, Pearson Publications, 2nd Edition, 2003.

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

Dept. of Electronics and Communication Engineering

Discipline Elective – V

18ECE418 ERROR CORRECTING CODES

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE102,18ECE109

Course Description:
This Course 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. Understand Block Codes for Binary Symmetric Channel and Maximum Likelihood Decoding algorithm and Shannon Theorem for good codes and, Macwilliams Krawtchouk polynomials.
2. Understand Linear block codes using Decoding Tables, Hamming Weight and Distance and Error Correction vs Error Detection.
3. Understand 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.
4. Design a Viterbi decoding algorithm using GDL, GDL perspective on Viterbi and BCJR Decoding algorithm and Turbo Coding.
5. Analyze and decoding the BCH and RS codes using finite field transform and combining the construction of codes.

UNIT I: BASICS OF BINARY BLOCK CODES FOR THE BINARY SYMMETRIC CHANNEL
Mathematical preliminaries: groups, subgroups and cosets, 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 and codes, the theorems of Macwilliams, Krawtchouk polynomials. **(9)**

UNIT II: LINEAR BLOCK CODES
Definitions, minimum distance, Bounds on the size of a block code, Hamming bound, Singleton bound, Gilbert-Varshamov bound, Plotkin bound. Using bounds to determine and design good codes for a given set of parameters. **(9)**

UNIT III: DECODING OF BINARY CODES
Bounded and maximum-likelihood decoding of binary block codes, standard array decoding, Weight distribution of the dual of a binary linear code, group characters and codes, the theorems of Macwilliams, Krawtchouk polynomials. **(9)**

UNIT IV: BASICS OF CONVOLUTIONAL CODES
Definition, the Viterbi decoding algorithm. The generalized distributive law (GDL). The GDL perspective on the Viterbi and BCJR decoding algorithms; Turbo coding. **(9)**

UNIT V: LDPC CODES
Fields; Polynomials rings; construction of finite fields. Deducing the structure of a finite field; Subfields and cyclotomic cosets. The finite field (Fourier) transform; cyclic codes via finite field transforms.BCH and Reed-Solomon codes; decoding of BCH and RS codes, Reed-Muller codes, Quadratic-residue codes. Combining constructions of codes. **(9)**

Course Outcomes:
After completing this course, the students should be able to:
1. Understand Block Codes and Maximum Likelihood Decoding algorithm, weight distribution dual of a binary code
2. Understand Decoding Tables, Hamming Weight and Distance and Error Correction vs Detection.
3. Understand the Bounding of Maximum likelihood algorithm, Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code.
4. Design an error detecting and correcting system to meet the given system specification using GDL Perspective on Viterbi and BCJR Decoding algorithms.
5. Analyze and construction of BCH and RS Codes using finite field Fourier transform

Text Books
1. Michael Purser, Introduction to Theory of Error Correcting Codes, Cambridge University Press 2006, ISBN-10: 0521845041 ISBN-13: 978-0521845045.

2. Todd K. Moon., Error Correction Coding: Mathematical Methods and Algorithms (1st Edition).

Reference Books
1. Online lecture notes by Prof.Madhu Sudan and a draft of a textbook by Venkat Guru swami, Madhu Sudan and Atri Rudra.

2. Online video lectures (https://goo.gl/63Kc29) by Prof. P. Vijay Kumar on the "nptelhrd" channel on you tube.

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

Discipline Elective – V

18ECE419 MOBILE COMMUNICATION AND NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE109

Course Description:
This course provides the fundamental aspects of various mobile communication standards- GSM, GPRS, 3G CDMA, 4G LTE-A and 5G. It provides detailed analysis of various access techniques, spread spectrum CDMA, and mobility management in mobile communication networks. It provides analysis on the implementation of MAC protocols, and cross layer design and integration of mobile IP and Ad-hoc networks.

Course Objectives:
This course enables students to
1. Understand the various mobile communication standards
2. Analyze the various multiple access techniques used in mobile communication networks.
3. Analyze the spread spectrum CDMA and mobility management in mobile communication networks.
4. Understand the mobile Ad-hoc networks and various mobile Wi-Fi IEEE standards
5. Analyze the cross-layer design and integration of mobile IP and Ad-hoc networks.

UNIT I: GSM AND OTHER MOBILE STANDARDS
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, Billing and Charging in GPRS, WAP , MMS , GPRS Applications, 3G W-CDMA; CDMA digital cellular standard, comparison between GSM and CDMA, 3G cdma2000, IMT-2000, 4G LTE-A and 5G.
(9)

UNIT II: ACCESS TECHNIQUES FOR MOBILE NETWORKS
Multiple access techniques like Frequency division multiple access (FDMA), Time division multiple access (TDMA), Code division multiple access (CDMA), Space division multiple access (SDMA). Mobile radio channels: Path-loss, slow-fading, fast-fading , delay spread and coherence bandwidth, flat fading and frequency selective fading ,The power budget design of mobile radio channels.
(9)

UNIT III: SPREAD SPECTRUM CDMA AND MOBILITY MANAGEMENT
Concept of Spread Spectrum, Frequency-Hopping Spread Spectrum, Coherent Binary Phase-Shift Keying DSSS, Quadrature Phase-Shift Keying DSSS , Bit Scrambling , Multipath Path Signal Propagation and Rake Receiver, Downlink (Forward) traffic channel, Uplink (Reverse) traffic channel, Power Control in CDMA Softer and Soft Handoff, Mobility Management Functions, Mobile Location Management, Mobility Model, Mobile Registration, GSM Token-Based Registration, IMSI Attach and IMSI Detach, Handoff techniques. **(9)**

UNIT IV: ADHOC NETWORKS

Definition, characteristics features, Application, Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models. Medium Access Protocols, MAC protocols: 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. **(9)**

UNIT V: CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G CROSS LAYER DESIGN

Need for cross layer design, cross layer optimization, parameter optimizations, techniques, cross layer cautionary perspective. Integration of Adhoc with mobile IP networks. Mesh networks, vehicular area networks. **(9)**

Course Outcomes:

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

1. Understand the various mobile communication standards.
2. Analyse the various multiple access techniques used in mobile communication networks.
3. Analyse the spread spectrum CDMA and mobility management in mobile communication networks.
4. Understand the mobile Ad-hoc network and various mobile Wi-Fi IEEE standards
5. Analyze the cross-layer design and integration of Mobile IP and Adhoc networks.

Text Books

1. Jochen H. Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2012.
2. Vijay K. Garg, “Wireless Communications and Networking”, Morgan Kaufmann Publishers (Elsevier), 2007.

Reference Books

1. Rappaport, T.S., “Wireless communications”, Second Edition, Pearson Education, 2010.
2. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education. 2007.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Aggelou, “Mobile Ad Hoc Networks”, Tata McGraw-Hill Education, 2004.

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

Discipline Elective – V

18ECE420 OPTICAL COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course mainly explains the basic concepts of Optical networks using circuit and packet switching. Optical signal multiplexing in optical networks using isolators and filters by providing channel spacing between transmitter and receiver to calculate wavelength and frequencies of optical network components. This concept eliminating cross talk and dispersion of optical fiber. Studying the elements of SONET/SDH infrastructure, architecture of optical network, routing and forwarding the optical channel through storage area networks.

Course Objectives:
This course enables students to

1. Understand Optical network system and its components.
2. Designing a transmission system, optical amplifier and eliminating noise.
3. Analyze Basic physical layer of optical network and optical signal routing concepts.
4. Designing a Statistical dimension model based on WDM Technique.
5. Understand Optical Network management techniques and functions.

UNIT I: INTRODUCTION TO OPTICAL NETWORKS AND COMPONENTS
Telecommunications Networks Architecture, Services, circuit switching and packet switching, Optical Networks: Multiplexing Techniques, second generation Optical Networks, Optical Packet Switching, Transmission Basics: Wavelength, frequencies, and channel spacing, Wavelength standards, Optical power and loss, Network Evolution, Components: Couplers, Isolators and Circulators, Multiplexers and Filters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength Converters.
(9)

UNIT II: TRANSMISSION SYSTEM ENGINEERING
System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Crosstalk, Dispersion, Fiber nonlinearities, Wavelength Stabilization, Overall Design Consideration. **(9)**

UNIT III: CLIENT LAYERS OF THE OPTICAL LAYER
Physical layer, Elements of a SONET/SDH Infrastructure. ATM: Functions of ATM, Adaptation Layers, Quality of Service, Flow Control, Signaling and Routing. IP: Routing and Forwarding, QOS. MPLS, Storage Area Networks: ESCON, Fiber Channel, HIPPI , Concepts of Gigabit and 10-Gigabit Ethernet. Architecture of Optical Transport Networks (OTNs): Digital wrapper, in- band and out-of-band control signaling. **(9)**

UNIT IV: WDM NETWORK ELEMENTS AND DESIGN

Optical line terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs, optical Cross Connects: All-optical OXC configurations. WDM Design: Cost Trade-Offs, LTD and RWA problems: Light path topology

design, wavelength conversion, Routing and wavelength Assignment, Statistical Dimensioning Models: First passage model, Blocking model, Maximum load dimension models: Offline light path Requests, Online RWA in Rings. **(9)**

UNIT V: NETWORK CONTROL & MANAGEMENT AND SURVIVABILITY

Network management functions, Optical layer services and Interfacing, layers with in Optical Layer, Multivendor Interoperability, Performance and fault management: Impact of transparency, BER management, DCN and Signaling, Policing, Optical layer overhead, Configuration management: Equipment, Connection and Adaptation management. Network Survivability: Basics, Protection in SONET/SDH, Protection in I/P networks, Optical network Protection schemes: 1+1 OMS protection, OMS-SP Ring, OCH-Mesh Protection. **(9)**

Course Outcomes:

At the end of the course, the student should be able to:

1. Understand the basics of optical network signal and its components.
2. Design the optical transmitter and it affecting diverse effects.
3. Analyze various layers in optical transport network
4. Design the optical network elements using WDM technique and eliminate cross talk.
5. Understand the protection of the optical fiber in optical communication network.

Text Books

1. Ramaswami, Rajiv, Kumar Sivarajan, and Galen Sasaki, "Optical Networks Practical Perspective", 3rd Edition, Morgan - Kaufmann Publishers,2009.

Reference Books

1. Black, Uyless D. Optical Networks, Third Generation Transport Systems, Uyless Black, Prentice Hall,2002.

2. Ilyas, Mohammad, and Hussein T. Mouftah, eds. The handbook of optical communication networks. CRC press, 2003.

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

DISCIPLINE ELECTIVE-VI

Dept. of Electronics and Communication Engineering

Discipline Elective – VI

18ECE421 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE115

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
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. **(9)**

UNIT II: DESIGN CONSIDERATION FOR WSN
Single-node architecture, Hardware components& design constraints. Operating systems and execution environments, introduction to TinyOS and nesC. **(9)**

UNIT III : WIRELESS PROTOCOLS
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee. **(9)**

UNIT IV: DATA PROCESSING
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. **(9)**

UNIT V: GATEWAY OF WSN
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. **(9)**

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.

Discipline Elective – VI

18ECE422 WAVELETS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: 18MAT107,18ECE104,18ECE110

Course Description:

The subject of "wavelet analysis" has drawn much attention from both mathematicians and engineers alike. Analogous to Fourier analysis, there are also two important mathematical entities in wavelet analysis: the "integral wavelet transform" and the wavelet series". This is an introductory description on wavelet analysis with an emphasis on wavelet transform, time-frequency analysis and its applications. This subject will help to understand the spectral analysis of real-time application like signal and image processing in higher study and research project.

Course Objectives:

This course enables students to

1. Describe the basics of signals and wavelets.
2. Solve the systems or process the signals using appropriate wavelet functions mathematically.
3. Explain about the time-frequency nature of the signals.
4. Discuss the analysis of multiresolution and filter bank.
5. Recognize the application of wavelets and its interpretation.

UNIT – I: INTRODUCTION

Basics of Continuous and Discrete-time Signal, Frequency domain analysis of Signal, Analysis of Fourier and Wavelet theory, the integral wavelet transform and time-frequency analysis, Inversion formulas and duals, Classification of wavelets, Multiresolution analysis, Wavelet decompositions and reconstructions. **(9)**

UNIT – II: WAVELET TRANSFORM

Short-time Fourier transform, Wigner-Ville transform; Continuous time wavelet transform, Discrete wavelet transform, tiling of the time-frequency plane and wave packet analysis, Construction of wavelets. **(9)**

UNIT – III: TIME-FREQUENCY ANALYSIS

Time-Frequency Analysis: Basic Concepts & Definition, The Gabor transform, Short-time Fourier transforms and the Uncertainty Principle, Continuous Wavelet Transform and its Computational aspects, Scale to Frequency conversion, Scalogram, Scaling Function and Wavelets. **(9)**

UNIT – IV: MULTIRESOLUTION AND FILTER-BANK ANALYSIS

Multiresolution analysis. Introduction to frames and biorthogonal wavelets, Multi-rate signal processing and Filter bank theory. **(9)**

UNIT – V: APPLICATIONS OF WAVELETS

Application of wavelet theory to signal denoising, image and video compression, multi-tone digital communication, transient detection. **(9)**

Course Outcomes

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

1. Describes the basics of signals and wavelets.
2. Mathematically solve the systems or process the signals using appropriate wavelet functions.
3. Explains about the time-frequency nature of the signals.
4. Discuss the analysis of multiresolution and filter bank.
5. Recognizing the application of wavelets and its interpretation.

Text Books

1. Chan. Y.T., Wavelet Basics, Kluwer Publishers, Boston, 1995.
2. Soman, K. P. Insight into wavelets: From theory to practice. PHI Learning Pvt. Ltd., 2010.

Reference Books

1. C. K. Chui, An Introduction to Wavelets, latest edition in 2016
2. I. Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, August 1992.
3. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, latest edition in 2011.
4. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey,latest edition in 2008.
5. A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Subbands and Wavelets, Academic Press, Oranld, Florida, latest edition in 2001
6. B.Boashash, Time-Frequency signal analysis, In S.Haykin, (editor), Advanced Spectral Analysis, pages 418--517. Prentice Hall, latest edition in 16th October 2003.

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

Discipline Elective – VI

18ECE423 MIXED SIGNAL DESIGN

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE105,18ECE110,18ECE113

Course Description:
This is an advanced course which focuses on core topics of Analog and Digital signal processing, switch capacitor filters, basics of data converters, mixed signal layout and frequency synthesizers. This course provides a mix of signal processing, CMOS IC Design fundamentals which includes the inclusion of data converteors, layout, frequency synthesizers and PLL.

Course Objectives:
This course enables students to
1. Acquire the knowledge of analog and discrete time signal processing
2. Understand the working of switched capacitor filters.
3. Understand the basics of data convertors, including various types of ADCs and DACs.
4. Apply the concept of mixed signal layout and voltage and current mode signalling and data transmission.
5. Design of frequency synthesizers

UNIT I: INTRODUCTION
Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous- time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform. **(9)**

UNIT II: SWITCHED FILTERS
Switched-capacitor filters- Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications. **(9)**

UNIT III: SIGNALS IN DATA CONVERTORS
Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs. **(9)**

UNIT IV: SIGNAL TRANSMISSION LAYOUT
Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission. **(9)**

UNIT V: DESIGN OF FREQUENCY SYNTHESIZERS
Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs. **(9)**

Dept. of Electronics and Communication Engineering

Course Outcomes:

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

1. Develop a thorough understanding of the fundamental concepts of mixed signal design.
2. Analyze and design switched capacitor circuits.
3. Understand, analyze and design various types of ADCs and DACs.
4. Understand the concept of mixed signal layout, voltage and current mode signaling and data transmission.
5. Understand, analyze and design various types of analog and digital PLLs.

Text Books

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.

Reference Books

1. R. Jacob Baker, CMOS circuit design, layout and simulation, revised second edition, IEEE press, 2008.
2. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
3. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
4. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
5. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford University press, first Indian edition, 2008.

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

Discipline Elective – VI

18ECE424 COGNITIVE RADIO

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE109

Course Description:
This course targets to discuss the cognitive radio and adaptive radio concepts from several aspects. It covers the need of improving the spectrum efficiency and effective methods to achieve it. It also gives an insight idea of machine learning in wireless communication systems

Course Objectives:
This course enables students to
1. Describing adaptive wireless communication systems.
2. Explaining the terms Spectrum, network, context, environment, location awareness for cognitive radio.
3. Understanding of Interference awareness, Signal analysis
4. Identifying of cognitive features in the upcoming wireless standards.
5. Understanding the emergence of Cognitive radio as a promising technology to efficiently utilize the scarce radio resources by allowing the unlicensed users.

UNIT I: INTRODUCTION TO COGNITIVE RADIOS
Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio **(9)**

UNIT II: SPECTRUM SENSING
Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models. **(9)**

UNIT III: OPTIMIZATION TECHNIQUES OF DYNAMIC SPECTRUM ALLOCATION
Linear programming, convex programming, non-linear programming, integer programming, dynamic programming and stochastic programming. **(9)**

UNIT IV: DYNAMIC SPECTRUM ACCESS AND MANAGEMENT
Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access. **(9)**

UNIT V: SPECTRUM TRADING
Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA, classification of auctions. **(9)**

Course Outcomes:

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

1. Understand the fundamental concepts of cognitive radio networks
2. Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
3. Explaining the technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
4. Describe fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.
5. Classifying of machine learning algorithms as an application to Cognitive Radio.
6. Understanding of the applications of auction theory as an economic approach to enable the emerging cognitive radio systems very useful.

Text Books

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
2. 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. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.
4. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

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

Dept. of Electronics and Communication Engineering

Discipline Elective – VI

18ECE425 ADAPTIVE SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Course Prerequisite: 18ECE104,18ECE110

Course Description:
The course aims at development of various adaptive signal processing algorithms and assessing them in terms of convergence rate, computational complexity, robustness against noisy data, hardware complexity, numerical stability etc. The course will present the concept of adaptive linear combiner and design of various adaptation filter algorithms, namely the LMS and the RLS algorithms along with their applications.

Course Objectives:
This course enables students to

1. Introduce the concept and application of linear algebra, vector spaces, random variables and stochastic processes in adaptive signal processing.
2. Understanding the concept of adaptive linear combiner and development of various adaptation filter algorithms, namely the LMS and the RLS algorithms.
3. Apply the steps for developing the filtering problem in the form of computing orthogonal projection on a signal subspace.
4. Understanding the concept of vector space formulation of RLS estimation and develop the adaptive version of the RLS lattice filters.

UNIT I: INTRODUCTION TO ADAPTIVE FILTERS
General concept of adaptive filtering and estimation, applications and motivation.
Discrete time stochastic processes: Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices. **(9)**

UNIT II: WIENER FILTER, SEARCH METHODS AND THE LMS ALGORITHM
Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex).
Convergence and Stability Analyses: convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment. **(9)**

UNIT III: VARIANTS OF THE LMS ALGORITHM
The sign LMS family, normalized LMS algorithm, blocks LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.
Signal space concepts - Introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram- Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces. **(9)**

UNIT IV: LATTICE FILTER AND ESTIMATOR
Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice. **(9)**

UNIT – V: RLS LATTICE FILTER

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array. **(9)**

Course Outcomes:

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

1. Understand the concept and application of linear algebra, vector spaces, random variables and stochastic processes in signal processing and communication.
2. Analyze convergence and stability issues associated with the design of optimal adaptive filter in particular linear estimators.
3. Design and implement of LMS algorithm and compute their expected performance.
4. Understand the concept of stochastic lattice filters on vector space and develop the adaptive version of the lattice i.e., gradient adaptive lattice.
5. Design and implement of RLS estimator in vector space and implement filtering solutions for RLS lattice filters.

Text Books

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, Wiley, 2008

Reference Books

1. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.
2. B. Farhang – Boroujeny, Adaptive Filters Theory and Applications", John Wiley and Sons, 1999.
3. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Third Edition, Springer, Kluwer Academic Publishers.
4. Alexander D Poularikas, Zayed M Ramadan, Adaptive Filtering Primer with MATLAB, CRC Press Taylor & Francis Group, 2008 Indian Edition.
5. Ali H. Sayed, Adaptive filters, IEEE Press, Wiley-Interscience, A john Wiley & Sons, INC., Publication
6. S. Thomas Alexander, “Adaptive Signal Processing-Theory & Applications,” Springer – Verlag, 1986.

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

MANDATORY

NON CREDIT COURSES

Dept. of Electronics and Communication Engineering

Mandatory Course

18CHE901 ENVIRONMENTAL SCIENCES

L	T	P	C
2	0	0	0

Course Prerequisites: 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)

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)

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)

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)

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)

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.

Mode of Evaluation: Assignments and Mid Term Tests

Mandatory Course

18HUM902 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Course Prerequisites:

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)

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)

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)

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)

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)

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.

References:

1. Sharma, 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 and Mid Term Tests

Mandatory Course

18HUM903 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	P	C
2	0	0	0

Course Prerequisite:
Basic understanding on Indian culture, traditions, and beliefs. Logistic approach towards learning.

Course Description:
This course deals with introducing and elaborating the importance and capabilities of the ancient, Indian Traditional Knowledge System in achieving heights of success and well-being towards humanity.

Course Objectives:
1. To get exposed to the basics of ITKS;
2. To understand the types and techniques used in Traditional Indian Medicine;
3. To introduce and elaborate the kind of art, architecture along with Vaastu Shashtra knowledge systems. To elucidate the product and construction technologies;
4. To familiarize the basic knowledge in ancient and traditional Astronomy and astrology along with aviation technologies in traditional knowledge systems; and
5. To acquire the knowledge on ancient contemporary world and IT revolution.

UNIT I: Indian Traditional Knowledge Systems (TKS) – Indian monuments; British Impact; Basics sciences - Philosophy and physical science; Indian physics; story of Kanada; Indian Chemistry; Indian Mathematics. **(6)**

UNIT II: (Traditional Medicine)
Ayurveda – origin, texts, the three greater classics, three lesser classics, concepts; manifestation of creation; mental constitution; three Doshas; individual constitution, clinical process and proceedings; sushruta Samhita and its contents; shastrakarma; Yoga; and siddha. **(6)**

UNIT III: Production and construction Technology; Art, Architecture and VastuShashtra; crafts and trade – Impact of Technology on society**(6)**

UNIT IV: Astronomy and Astrology; Aviation technology in Ancient India - Vedic Astronomy; Eclipses, calculations using earths circumferences; Heliocentric theory of Gravitaton; vedic Astrology; Vaimanika Sastra and its ancient notes. **(6)**

UNIT V: Information Technology in India – trends – Contemporary issues of IT Industry – Impact of IT on Indian society**(6)**

Course Outcomes:

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

1. Understand the basics of Indian Traditional Knowledge System and the origin of basic science and Mathematics,
2. Get familiarized with various traditional medical methods and their implications in the human betterment,
3. Understand various production and construction technologies along with art and architectural implications in TKS,
4. Get the knowledge Vedic astronomy and astrology and get to know the ancient aviation technologies, and
5. Understand the outreach of the TKS to the contemporary world and gain the Indian action in protecting the TKS along with IT revolution.

Text Books:

1. Traditional Knowledge System in India, Amit Jha, Atlantic publishers, 2009. ISBN: 978-81-269-1223-0.
2. Traditional Knowledge System & Technology In India, Basanta Kumar Mohantra, Pratibha Prakashan (2012), ISBN-10: 8177023101

References:

1. Online Materials

Mode of Evaluation: Assignments and Mid Term Tests.

Dept. of Electronics and Communication Engineering

Mandatory Course

18CE904 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Prerequisite: 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:

1. To make aware the students about disasters and their impact on living beings.
2. To 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)

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

UNIT II: TYPES OF DISASTERS (6)

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)

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social 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)

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)

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:

The student will develop competencies in:

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

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/ (National Disaster management in India, Ministry of Home Affairs).
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

Honors in Electronics & Communication Engineering

Dept. of Electronics and Communication Engineering

Honors in ECE

18HDECE101 DIGITAL VLSI DESIGN

Course Description:

This course enables the students to understand the concepts of MOS design, Combinational MOS circuits, Sequential MOS logic circuits and Dynamic logic circuits. Also this course covers the memory design by logic devices

Course Objectives:

This course enables students to

1. Understand the MOS design circuits
2. Study the combinational MOS circuits.
3. Study the sequential MOS circuits.
4. Learn the dynamic logic circuits.
5. Understand the semiconductor memories.

UNIT I: MOS DESIGN

Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic. **(9)**

UNIT II: COMBINATIONAL MOS LOGIC CIRCUITS

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates. **(9)**

UNIT III: SEQUENTIAL MOS LOGIC CIRCUITS

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch, and edge triggered flip-flop. **(9)**

UNIT IV: DYNAMIC LOGIC CIRCUITS

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits. **(9)**

UNIT V: SEMICONDUCTOR MEMORIES

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash. **(9)**

Course Outcomes:

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

1. Recognise the MOS design circuits
2. Design the combinational MOS circuits.
3. Design the sequential MOS circuits.
4. Describe the dynamic logic circuits.
5. Realize the semiconductor memories.

Text Books:

1. Ken Martin, “Digital Integrated Circuit Design”, Oxford University Press, 2011.
2. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, TMH, 3rd Edition, 2011.

Reference Books:

1. Ming-BO Lin, “Introduction to VLSI Systems: A Logic, Circuit and System Perspective”, CRC Press, 2011
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits – A Design Perspective”, 2nd Edition, PHI.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE102 ADVANCED DIGITAL SYSTEM DESIGN

Course Description:

This course enables the students to know the concepts of sequential circuit design, asynchronous sequential circuit design and synchronous sequential design. This course covers the fault diagnosis and testability algorithms and system design using VHDL

Course Objectives:

This course enables students to

1. Understand the sequential circuit design.
2. Study the asynchronous sequential circuit design.
3. Know the fault diagnosis and testability.
4. Design the synchronous design using programmable device.
5. Design the logic circuits using VHDL.

UNIT I: SEQUENTIAL CIRCUIT DESIGN

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization. **(9)**

UNIT II: ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits. **(9)**

UNIT III: FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS

Fault Table Method – Path Sensitization Method – Boolean Difference Method – D Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle– DFT Schemes – Built-in Self-Test. **(9)**

UNIT IV: SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES

Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a PAL – Realization State machine using PLD –Complex Programmable Logic Devices (CPLDs) - FPGA – Xilinx FPGA – Xilinx 3000 - Xilinx 4000. **(9)**

UNIT V: SYSTEM DESIGN USING VHDL

VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modeling using VHDL – Flip Flops – Registers – Counters – Sequential Machine – Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier – Binary Divider – complete Sequential Systems – Design of a Simple Microprocessor.

(9)

Course Outcomes:

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

1. Recognize the sequential circuit design.
2. Describe the asynchronous sequential circuit design.
3. Identify the fault diagnosis and testability.
4. Design the synchronous design using programmable device.
5. Design the logic circuits using VHDL.

Test Books:

1. Nelson V.P., Nagale H.T., Carroll B.D., and Irwin J.D., "Digital Logic Circuit Analysis and Design",Prentice Hall International Inc.1995.
2. Nripendra N Biswas "Logic Design Theory" Prentice Hall of India, 2001.

Reference Books:

1. Charles H. Roth Jr. "Digital System Design using VHDL" Thomson Learning, 1998.
2. Stephen Brown and Zvonk Vranesic "Fundamentals of Digital Logic with VHDL Design" Tata McGraw Hill, 2002.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE103 REAL TIME OPERATING SYSTEMS

L	P	T	C
3	0	0	3

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-1: INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

(9)

Unit II: RTOS POLICIES

Preemptive 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, I/O Architecture.
Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems. **(9)**

Unit III: MULTI-RESOURCE SERVICES

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. **(9)**

Unit IV: EMBEDDED SYSTEM COMPONENTS

Firmware components, RTOS system software mechanisms, Software application components. 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. **(9)**

Unit V: HIGH AVAILABILITY AND RELIABILITY DESIGN

Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design. Design of RTOS – PIC microcontroller. **(9)**

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 Books:

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. Tanenbaum, Modern Operating Systems, 4th edition, Pearson Edition, 2015.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE104 ADVANCED DIGITAL SIGNAL PROCESSING

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

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. **(9)**

UNIT II: SPECTRUM ESTIMATION

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. **(9)**

UNIT III: LINEAR ESTIMATION AND PREDICTION

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. **(9)**

UNIT IV: ADAPTIVE FILTERS

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. **(9)**

UNIT V: MULTIRATE DIGITAL SIGNAL PROCESSING

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.

(9)

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 Books:

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: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE105 NEURAL NETWORK AND FUZZY LOGIC

Course Description:

This course enables the students to understand the concepts of neural networks, single layer, and multilayer neural networks. Also it covers the usage of Fuzzy logic techniques.

Course Objectives:

This course enables students to

1. Understand the introduction of neural networks
2. Study the single layer feed-forward layer.
3. Study the multilayer feed-forward layer.
4. Understand the fuzzy logic techniques and it applications.

UNIT I: INTRODUCTION TO NEURAL NETWORKS

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. **(9)**

UNIT II: SINGLE LAYER FEED FORWARD NEURAL NETWORKS

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. **(9)**

UNIT III: MULTILAYER FEED FORWARD NEURAL NETWORKS

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. **(9)**

UNIT IV: INTRODUCTION TO FUZZY LOGIC

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule-based systems – fuzzification and defuzzification – types. **(9)**

UNIT V: FUZZY LOGIC APPLICATIONS

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – syntactic recognition – fuzzy optimization. **(9)**

Dept. of Electronics and Communication Engineering

Course Outcomes:

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

1. Recognise the introduction of neural networks
2. Design the single layer feed-forward layer.
3. Design the multilayer feed-forward layer.
4. Describe the fuzzy logic techniques.
5. Demonstrate the applications of fuzzy logic techniques

Text Books:

1. Freeman, James A., and David M. Skapura. Neural networks: algorithms, applications, and programming techniques. Addison Wesley Longman Publishing Co., Inc., 1991.
2. Fausett, Laurene V. Fundamentals of neural networks: architectures, algorithms and applications. Pearson Education India, 2006.

Reference Books:

1. Haykin, Simon S. "Neural networks and learning machines/Simon Haykin." (2009).
2. Rajasekaran, Sanguthevar, and GA Vijayalakshmi Pai. Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd., 2003.
3. Klir, George, and Bo Yuan. Fuzzy sets and fuzzy logic. New Jersey: Prentice hall, 1995.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE106 ADVANCED COMMUNICATION NETWORKS

Course Description:

This course gives fundamental knoweldege on andvanced communication networks and its different models. The different layer of TCP/IP protocol has been elaborated in this course. All the seven layers operation and models have been included in the course.

Course Objectives:

This course enables students to

1. Understand the introduction of TCP/IP model
2. Know the different types error correcting and detecting codes.
3. Understand the MAC layers.
4. Learn the different switching techniques.
5. Know the working of network layer.

UNIT I: INTRODUCTION

Networks and Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP protocol suite, OSI Model. Digital Data Transmission, DTE-DCE interface.

Data Link Layer: Introduction, Data Link Layer, Nodes and Links, Services, Categories of Links, sub layers, Link Layer Addressing, Address Resolution Protocol. **(9)**

UNIT II: ERROR DETECTION AND CORRECTION

Types of Errors, Redundancy, detection versus correction, Coding Block Coding: Error Detection, Vertical redundancy cheeks, longitudinal redundancy cheeks, Error Correction, Error correction single bit, Hamming code.

Cyclic Codes: Cyclic Redundancy Check, Polynomials, Cyclic Code Encoder Using Polynomials, Cyclic Code Analysis, Advantage of Cyclic Codes, Checksum

Data Link Control: DLC Services, Data Link Layer Protocols, HDLC, Point to Point Protocol

(9)

UNIT III: MEDIA ACCESS CONTROL (MAC) SUB LAYER

Random Access, ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation, Polling- Token Passing, Channelization - Frequency Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA).

Wired LANS: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Giga bit Ethernet **(9)**

UNIT IV: SWITCHING

Introduction to Switching, Circuit Switched Networks, Packet Switching, Structure of switch **Multiplexing**: Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing. **Connecting devices**: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks. **(9)**

UNIT V: NETWORKS LAYER

Packetizing, Routing and Forwarding, Packet Switching, Network Layer Performance, IPv4 Address, Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NATF), Forwarding of IP Packets, Forwarding based on Destination Address, Forwarding based on Label, Routing as Packet Switches. Unicast Routing: Introduction, Routing Algorithms-Distance Vector Routing, Link State Routing, Path Vector Routing,

Unicast Routing Protocols- Routing Information Protocol (RIP), Open Short Path First. **(9)**

Course Outcomes

Upon the completion of the course student will be able to

1. Demonstrate the introduction of TCP/IP model
2. Describe the different types error correcting and detecting codes.
3. Design the MAC layers.
4. Analyse the different switching techniques.
5. Demonstrate the working of network layer.

Text Books:

1. Data Communications and Networking - B. A. Forouzan, 5th Ed., TMH, 2013.
2. Data and Computer Communications - William Stallings, 8th Ed., PHI, 2007.

Reference Books:

1. Data Communications and Computer Networks - Prakash C. Gupta, PHI, 2006.
2. Data Communications and Networking - B. A. Forouzan, 2nd Ed., TMH, 2013.
3. Data Communications and Computer Networks- Brijendra Singh, 2nd Ed., 2008.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE107 SYSTEM ON CHIP DESIGN

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

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. **(9)**

UNIT II: PROCESSORS

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. **(9)**

UNIT III: MEMORY DESIGN FOR SOC

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. **(9)**

UNIT IV: INTERCONNECT CUSTOMIZATION AND CONFIGURATION

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. **(9)**

UNIT V: APPLICATION STUDIES / CASE STUDIES

SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression. **(9)**

Course Outcomes

Upon the completion of the course student 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 Books:

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: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE108 VLSI SIGNAL PROCESSING

Course Description:

The signal processing design has been covered with VLSI approach. The retiming, folding and unfolding techniques have been covered in the course. Also, programmable DSP covered in the course.

Course Objectives:

This course enables students to

1. Understand the introduction of DSP systems
2. Know the different types retiming techniques.
3. Understand the fast convolution.
4. Learn the bit level arithmetic circuits.
5. Know the programmable DSP.

UNIT I: INTRODUCTION TO DSP SYSTEMS

Introduction To DSP Systems -Typical DSP algorithms; Iteration Bound – data flow graph representations ,loop bound and iteration bound, Longest path Matrix algorithm; Pipelining and parallel processing –Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power. **(9)**

UNIT II: RETIMING, FOLDING AND UNFOLDING

Retiming - definitions and properties Retiming techniques; Unfolding – an algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Folding – Folding transformation – Register minimizing techniques – Register minimization in folded architectures. **(9)**

UNIT III: FAST CONVOLUTION

Fast convolution – Cook-Toom algorithm, modified Cook-Took algorithm – Winograd Algorithm, Iterated Convolution – Cyclic Convolution; Pipelined and parallel recursive and adaptive filters – inefficient/efficient single channel interleaving, Look- Ahead pipelining in first- order IIR filters, Look Ahead pipelining with power-of-two decomposition parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters, relaxed look-ahead, pipelined LMS adaptive filter. **(9)**

UNIT IV: BIT-LEVEL ARITHMETIC ARCHITECTURES

Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh- Wooley carry-save multiplication tabular form and implementation, design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement. **(9)**

UNIT V: PROGRAMMING DIGITAL SIGNAL PROCESSORS

Synchronous, Wave and asynchronous pipelining- synchronous pipelining and clocking styles, clock skew in edge-triggered single-phase clocking, two-phase clocking, wave pipelining, asynchronous pipelining bundled data versus dual rail protocol; Programming Digital Signal Processors – general architecture with important features; Low power Design – needs for low power VLSI chips, charging and discharging capacitance, short-circuit current of an inverter, CMOS leakage current, basic principles of low power design. **(9)**

Course Outcomes

Upon the completion of the course student will be able to

1. Understand the introduction of DSP systems
2. Know the different types retiming techniques.
3. Understand the fast convolution.
4. Learn the bit level arithmetic circuits.
5. Know the programmable DSP.

Text Books:

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley, Inter Science, 1999.

Reference Books:

1. Gary Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, 1998.
2. Mohammed Isamail and Terri Fiez, "Analog VLSI Signal and Information Processing", Mc Graw-Hill, 1994.
3. S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors in ECE

18HDECE109 ASIC DESIGN

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

Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance Logical effort, Library cell design - Library architecture. **(9)**

UNIT II: PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS

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. **(9)**

UNIT III: PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN 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. **(9)**

UNIT IV: LOGIC SYNTHESIS, SIMULATION AND TESTING

Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test – fault simulation - automatic test pattern generation. **(9)**

UNIT V: ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING
System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC. **(9)**

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 Books:

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.

Reference Books:

1. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
2. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
3. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.
4. J.Bhaskar, “ A VHDL Synthesis Primer” BS Publications , 2001.
5. Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis. Vol. 1. Prentice Hall Professional, 2003.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Minors in Electronics & Communication Engineering

Stream Name: Communication Systems (CS)

Dept. of Electronics and Communication Engineering

Minor in ECE

18MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	T	P	C
3	0	0	3

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

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. **(9)**

UNIT II: TRANSISTORS

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. **(9)**

UNIT III: APPLICATIONS OF DIODES AND TRANSISTORS

p-n 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. **(9)**

UNIT IV: OPERATIONAL AMPLIFIERS

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. **(9)**

UNIT V: APPLICATIONS OF OPERATIONAL AMPLIFIER

Nonlinear Op-amp circuits: Log and antilog Amplifiers, Analog switch - Sample and Hold circuit Analog multipliers, Precision rectifiers, - Comparators and Schmitt Trigger - Active filters. **(9)**

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 Books

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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE102 COMPUTER COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course develops 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

6. Understand the basic concepts of the data communication and layered architecture.
7. Acquire knowledge in data link layer on coding, flow control, error control and MAC layer.
8. Understand the basics of IP addressing and the network protocols in network layer.
9. Acquire the knowledge involved in connection-oriented and connectionless protocol, congestion control and QoS related to transport layer.
10. Understand the requirement of user to machine interfacing application layer protocols, multimedia and security.

UNIT I: DATA COMMUNICATION COMPONENTS
Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, TCP/IP Model, Border Gateway Protocol (BGP), Asynchronous Transfer Mode (ATM), 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. **(9)**

UNIT II: DATA LINK LAYER
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. **(9)**

UNIT III: NETWORK LAYER
Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. **(9)**

UNIT IV: TRANSPORT LAYER
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. **(9)**

UNIT V: HIGHER LAYERS

Client Server Model, Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Multimedia, Bluetooth, Firewalls, Cryptography. **(9)**

Course Outcomes

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

6. Describe the phases, identify, list and compare aspects of Data Network.
7. Understand the characteristics and selection of suitable Data link and MAC layer protocols for computer communication networks.
8. Classify and select suitable masking and routing techniques in Network layer for large network.
9. Discuss and identify suitable protocols in Transport layer to be applicable for computer communication networks.
10. Sketch a network including aspects of application layer for computer communication networks.

Text Books

3. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill, 4th Edition, 2007
4. Data and Computer Communication, William Stallings, Pearson Education,8th Edition, 2007

Reference Books

4. Computer Networks, Andrew S.Tanenbaum, Pearson New International Edition, 2013
5. Internetworking with TCP/IP, Douglas Comer, Prentice Hall of India, Volume 1, 6th Edition, 2015
6. TCP/IP Illustrated, W. Richard Stevens, Addison-Wesley, United States of America, Volume 1,2nd Edition,2011

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

Dept. of Electronics and Communication Engineering

Minor in ECE

18MDECE103 ANALOG AND DIGITAL COMMUNICATIONS

L	T	P	C
3	0	0	3

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

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

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. **(9)**

UNIT II: ANALOG MODULATION

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. **(9)**

UNIT III: DIGITAL KEYING TECHNIQUES

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. **(9)**

UNIT IV: SHIFT KEYING TECHNIQUES

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. **(9)**

UNIT V: SIGNALS CONDITIONING

Linear Block Codes- Convolutional codes- Linear equalization and Decision Feedback techniques for band-limited channels- Adaptive Equalization- Synchronization and Carrier Recovery for Digital modulation. **(9)**

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 Books

1. Simon Haykin and Michale Moher, "An Introduction to Analog and Digital Communications", 2^{nd} Edition, John Wiley and Sons, 2007.
2. B. P. Lathi and Zhi Ding, "Modern Analog and Digital Communication Systems", 4^{th} Edition, Oxford University Press, 2010.
3. Simon Haykin and Michale Moher, "Communication Systems", 4^{th} 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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE104 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

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

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. **(9)**

UNIT II: MODULATION, MULTIPLEXING, MULTIPLE ACCESS TECHNIQUES AND TRANSMISSION THEORY

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.

(9)

UNIT III: EARTH STATIONS AND RADIO WAVE PROPAGATION EFFECTS

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.

(9)

UNIT IV: COMMERCIAL SATELLITE SYSTEMS AND VAST SYSTEMS

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.

(9)

UNIT V: MOBILE SATELLITE COMMUNICATIONS, NON-GEOSTATIONARY SATELLITE ORBIT (NGSO) SYSTEMS AND GPS

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.

(9)

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 Books

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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE105 OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

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
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. **(9)**

UNIT II: OPTICAL SOURCES
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. **(9)**

UNIT III: PHOTO DETECTORS
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. **(9)**

UNIT IV: OPTICAL AMPLIFIERS
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. **(9)**

UNIT V: MULTIPLEXING CONCEPTS AND OPTICAL SYSTEMS
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. **(9)**

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 Books

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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE106 MOBILE TELECOMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Course Description:

This course provides an overview of mobile telecommunication standards, technology and network architectures. Topics include concepts of wireless communication and its evolutions; multiple access techniques: FDMA, TDMA, CDMA; concepts of cellular system design; radio wave propagation in outdoor and indoor environment; 2G GSM mobile telecommunication standards and network architecture; overview of IS-95 CDMA standards and its physical layer structure; 3G universal mobile telecommunication (UMT) standards and network architecture; 4G LTE technology: OFDM, MIMO and LTE network architecture.

Course Objectives:

This course enables students to

1. To understand the concept wireless communication and multiple access techniques.
2. To analyze the concepts of cellular system design and radio propagation mechanism.
3. To study GSM, GPRS mobile communication standards and network architecture.
4. To understand IS-95 CDMA mobile communication standards and network architecture.
5. To study about 3G and 4G wireless standard and network architecture.

UNIT I: INTRODUCTION TO WIRELESS COMMUNICATION AND MULTIPLE ACCESS TECHNIQUES

Concepts of Wireless, Mobile and Portable Networks, Introduction to 1G, 2G, 3G, 4G wireless networks and their evolution, TDMA, FDMA, Spread spectrum multiple access: FHMA, CDMA, Space division multiple access, Packet radio, capacity of cellular systems. **(9)**

UNIT II: CELLULAR DESIGN CONCEPT & PROPAGATION MECHANISM

Cellular system design, Frequency reuse, handoff, Interference and system capacity, Trunking and Grade of service, Coverage and Capacity in cellular systems, 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, Traffic models and blocking formula.
(9)

UNIT III: SECOND GENERATION CELLULAR MOBILE NETWORKS

GSM architecture and Interfaces, Radio Link features, Logical channels and frame structure, speech coding, message, services and call flow, Signaling System 7, Reference architecture of GPRS (SGSN, GGSN), EDGE Rel' 99, Evolution of GERAN, standardization Privacy and security in GSM.
(9)

UNIT IV: OVERVIEW OF CDMA IS-95: 2G CELLULAR NETWORK

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, Spectrum in India and its allocations, Different frequency bands allocated for 2G, 3G and LTE. **(9)**

UNIT V: 3G AND 4G CELLULAR MOBILE COMMUNICATION AND NETWORKS
UTRAN architecture, UMTS physical layer, UMTS core network architecture, HSDPA, FOMA CDMA 2000 and its layering structure, Evolution of CDMA: 1X EVDO, 1X EVDV, differences between cdma2000 and WCDMA, current trends: OFDM, MIMO, LTE and Beyond 4G. **(9)**

Course Outcomes:
Upon completion of this course the students should be able to:
1. Understand the concepts of wireless communication, their evolutions and various multiple access techniques.
2. Analyze the cellular system design concepts and mobile radio propagation mechanism.
3. Study of GSM mobile communication standards, its network architecture, logical channel, call processing, speech coding and security.
4. Understanding of IS-95 CDMA wireless standards, forwards and reverse link, power control, rake receiver and soft-handoff.
5. Study of 3G and 4G wireless standards, technology and network architecture.

Text Books
1. Theodore S. Rappaport, “Wireless Communication Principles and Practice” 2nd Edition, Pearson Education Asia, 2002.
2. Jochen Schiller, “Mobile Communication”, 2nd Edition, Pearson Education India, 2007.
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.

Reference Books
1. William C.Y. Lee, “Mobile Cellular Telecommunications-Analog & Digital Systems”, Mc.Graw Hill, 1995
2. Vijay Garg, “Wireless communication and networking”, Morgan Kaufmann publishers, Imprint of Elsevier, 2008
3. Vijay Garg, “IS-95 CDMA and CDMA 2000 - Cellular/PCS system implementation”, Pearson Education, 2000.
4. Michael D. Gallagher and Raandall A. Snyder, “Mobile Telecommunications Networking, With IS-41, McGram-hill, 1997.

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

Minor in ECE

18MDECE201 ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

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

Minors in Electronics & Communication Engineering
Stream Name: Embedded Systems (ES)

Dept. of Electronics and Communication Engineering

Minor in ECE

18MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	P	T	C
3	0	0	3

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 device, i.e., the p-n junction diode
2. Understand the operation of BJTs 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

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. **(9)**

UNIT II: TRANSISTORS

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. **(9)**

UNIT III: APPLICATIONS OF DIODES AND TRANSISTORS

p-n 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. **(9)**

UNIT IV: OPERATIONAL AMPLIFIERS

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. **(9)**

UNIT V: APPLICATIONS OF OPERATIONAL AMPLIFIER

Nonlinear Op-amp circuits: Log and antilog Amplifiers, Analog switch - Sample and Hold circuit - Analog multipliers, Precision rectifiers, - Comparators and Schmitt Trigger - Active filters. **(9)**

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. Explain the operation of BJTs, JFETs and MOSFETs.
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Explain the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Books

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.

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

Minor in ECE

18MDECE107 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

Course Description:

This course provides computer architecture, instruction set design, memory organization, ALU operations, I/O interfaces and multi computing systems.

Course Objectives:

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

Introduction to computer abstractions and technology, CPU performance, the power wall, Switch from uniprocessors to multiprocessors. **(9)**

UNIT II: INSTRUCTIONS

Operations and Operands of the computer hardware, Signed and unsigned numbers, Representing instructions, Logical operations, Instructions for making decisions, Supporting procedures in computer hardware, Communicating with people, MIPS architecture and instruction set. **(9)**

UNIT III: PIPELINE ARCHITECTURES

Logic design conventions, data path design, a simple implementation scheme, Control hardware, Pipelining overview, Pipelined data-path and control. **(9)**

UNIT IV: ARITHMETIC OPERATIONS

Addition, Subtraction, Multiplication, Division, Floating point arithmetic, Parallelism and Computer Arithmetic, Floating point in the x86, Forwarding versus stalling, Control hazards, Exceptions, Branch prediction. **(9)**

UNIT V: MEMORY ORGANIZATIONS & MULTI-PROCESSORS

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. **(9)**

Course Outcomes:

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

1. Fundamental the technology behind computers.
2. To learn various instructions of a computer.
3. Analysis and explain pipelining and its implementation.
4. To investigate the algorithms for arithmetic operations.
5. Design memory organization, multi processors and clusters.

Text Books

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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE108 ADVANCED MICROPROCESSORS

L	P	T	C
3	0	0	3

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. Study the Architecture of 80186/80188 Microprocessor.
2. Study the addressing modes and instruction set of 80186/80188.
3. Know the architecture of 80286, 80386 & 80486
4. Understand Superscalar Architecture and advanced instruction sets of Pentium Microprocessor
5. Study the Special Pentium Pro Features and applications

UNIT I: 8086 MICROPROCESSOR

The 8086 Microprocessor: Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming. **(9)**

UNIT II: INTRODUCTION TO THE INTEL 80186/80188

80186/80188 Architecture, Versions of the 80186/80188, 80186 Basic Block Diagram, 80186/80188 Basic Features, 80186/80188 Timing diagram. **(9)**

UNIT III: PROGRAMMING THE 80186/80188

Enhancements, Peripheral Control Block, Interrupts in the 80186/80188, DMA Controller, Chip Selection Unit. **(9)**

UNIT IV: INTRODUCTION TO THE 80286, 80386 & 80486

Hardware Features, Additional Instructions, the Virtual Memory Machine, The 80386 and 80486 Microprocessors, introduction to the 80386 microprocessor, the memory system, the input/output system, memory and i/0 control signals, special 80386 registers, debug and test registers, 80386 memory management, descriptors and selectors, the task state segment (tss), moving to protected mode, virtual 8086 mode, the memory paging mechanism, the page directory, Basic 80486 Architecture, 80486 Memory System. **(9)**

UNIT V: INTRODUCTION TO THE PENTIUM MICROPROCESSOR

The Memory System, Input/Output System, System Timing, Superscalar Architecture, SPECIAL Pentium Registers, Pentium Memory Management, New Pentium Instructions. Internal Structure of the Pentium Pro, Pin Connections, the Memory System, System Timing, Special Pentium Pro Features and applications. **(9)**

Course Outcomes:

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

1. Explain the Architecture of 80186/80188 Microprocessor.
2. Describe the addressing modes and instruction set of 80186/80188.
3. Explain the architecture of 80286, 80386 & 80486
4. Clarify the Superscalar Architecture and advanced instruction sets of Pentium Microprocessor
5. Illuminate the Special Pentium Pro Features and applications.

Text Books

1. Barry B.Brey, The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Prentice Hall of India Private Limited, New Delhi, 2009.
2. John Peatman, Design with Microcontroller McGraw Hill Publishing Co Ltd, New Delhi.

Reference Books

1. Alan Clements, “The principles of computer Hardware”, Oxford University Press, 4th Edition, 2006.
2. Rajkamal, The concepts and feature of micro controllers 68HC11, 8051 and 8096; S Chand Publishers, New Delhi. 2005

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

Minor in ECE

18MDECE109 MICROCONTROLLER PROGRAMMING WITH TI- MSP 430

L	P	T	C
3	0	0	3

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

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. **(9)**

UNIT II: ARCHITECTURE OF THE MSP430 PROCESSOR

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. **(9)**

UNIT III: PORT PROGRAMMING

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. **(9)**

UNIT IV: WATCHDOG TIMER

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. **(9)**

UNIT V: COMMUNICATIONS WITH MSP-430

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. **(9)**

Course Outcomes:

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

2. Demonstrate the basic of MSP430.
3. Explain the components of MSP430 Processor architecture and different instruction sets.
4. Design the port programming and interfacing techniques.
5. Design the timer and counter for various modulation schemes of MSP 430.
6. Explain the different communication buses used in MSP430.

Text Books

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: Assignments, Mid Term Tests, End Semester Examination.

Minor in ECE

18MDECE110 ARM – SYSTEM ON CHIP ARCHITECTURE

L	P	T	C
3	0	0	3

Course Description:

This course gives introduction to the students to understand 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. Study the basic of ARM processor.
2. Know the different instruction sets and pipelining
3. Study the advanced instruction sets.
4. Understand the ARM programming and interfacing techniques.
5. Know the different ARM Processor cores.

UNIT I: AN INTRODUCTION TO ARM PROCESSOR

Processor architecture and organization, Abstraction in hardware design, MU0 - a simple processor, Instruction set design, Processor design trade-offs, The Reduced Instruction Set Computer, The Acorn RISC Machine, Architectural inheritance, The ARM programmer's model, ARM development tools. **(9)**

UNIT II: ARM ASSEMBLY LANGUAGE PROGRAMMING

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. **(9)**

UNIT III: **ARM INSTRUCTION SETS**

Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions. **(9)**

UNIT IV: THUMB INSTRUCTION SETS

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. **(9)**

UNIT V: ARM PROCESSOR CORES

ARM7TDMI, ARM8 256, ARM9TDMI 260, ARM10TDMI 263. **(9)**

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

1. Explain the basic of ARM processor.
2. Describe the different instruction sets and pipelining.
3. Design the ARM programming and interfacing techniques.
4. Describe the advanced instruction sets.
5. Explain the different ARM Processor cores.

Text Books

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

3. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
4. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)", Newnes, BK and CDROM.
5. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

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

III Year II Semester

18MDECE202 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	4	2

Course Objectives:

1. To understand the different types of instruction sets, addressing modes of 8086 and ARM
2. To study the architecture of MSP-430

Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations (Sorting, Code Conversion)

Part B: ARM based Experiments

1. Familiarization with ARM board.
2. RS-232C interface with PC.
3. Traffic Light Controller.
4. SPI/CAN interface.
5. ADC interfacing

Part C: 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 in ECE

18MDECE111 REAL TIME OPERATING SYSTEMS

L	P	T	C
3	0	0	3

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

6. Understand the introduction of real-time embedded systems
7. Know the different types of policies.
8. Understand the Multi-resource Services techniques.
9. Learn the Embedded System Components.
10. Know the embedded system design based on availability and reliability.

UNIT-1: INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

(9)

UNIT II: RTOS POLICIES

Preemptive 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, I/O Architecture. Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems. **(9)**

UNIT III: MULTI-RESOURCE SERVICES

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. **(9)**

UNIT IV: EMBEDDED SYSTEM COMPONENTS

Firmware components, RTOS system software mechanisms, Software application components. 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. **(9)**

UNIT V: HIGH AVAILABILITY AND RELIABILITY DESIGN

Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design. Design of RTOS – PIC microcontroller. **(9)**

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 Books

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. Tanenbaum, Modern Operating Systems, 4th edition, Pearson Edition, 2015.

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