MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE MADANAPALLE

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

BACHELOR OF TECHNOLOGY

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE
&
DETAILED SYLLABI

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

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

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: ELECTRONICS AND COMMUNICATION ENGINEERING

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

I. Induction Program and Holistic Development Activities

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

Dept. of Electronics and Communication Engineering

R20 - Curriculum Structure

I Year I Semester

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

I Year II Semester

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

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

II Year I Semester

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

II Year II Semester

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

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

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III Year I Semester

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

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

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

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

III Year II Semester

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

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

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Tentative Structure from IVth Year onwards

IV Year I Semester

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

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

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	20ECE703	Project Work, Seminar and Internship in Industry (6 months)	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

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

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

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

- ***Proficiency modules***

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

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

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

ANNEXURE - II

OPEN ELECTIVE – I (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20CE3M01	Integrated Waste Management for Smart City	Civil
4	20CE3M02	Soil and Water Conservation Engineering	Civil
5	20CE3M03	Plastic Waste Management	Civil
6	20CE3M04	Safety in Construction	Civil
7	20ME3M01	Introduction to Industry 4.0 and Industrial Internet of Things	Mechanical
8	20ME3M02	Operations Research	Mechanical
9	20ME3M03	Design Thinking and Innovation	Mechanical
10	20EEE3M01	Non-Conventional Energy Sources	EEE
10	20EEE3M02	Design of Photovoltaic Systems	EEE
11	20CSE3M01	Online Privacy	CSE
12	20CSE3M02	Privacy and Security in Online Social Media	CSE
13	20CSE3M03	Social Networks	CSE
14	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
15	20IE3M02	Introduction to Research	Multidisciplinary
16	20IE3M03	Roadmap for Patent Creation	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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

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OPEN ELECTIVE – III

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

S.No	Course Code	Course Title	Course Offered by Department of
1	20CE3M04	Remote Sensing and GIS	Civil
2	20CE3M05	Waste Water Treatment and Recycling	Civil
3	20ME3M04	Power Plant Engineering	Mechanical
4	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
5	20EEE3M03	Introduction to Smart Grid	EEE
6	20CSE3M04	Software Project Management	CSE
7	20CSE3M05	Software Testing	CSE
8	20CSE3M06	Multi-Core Computer Architecture – Storage and Interconnects	CSE

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

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OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
S.No	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20MAT303	Graph Theory	Mathematics
2	20MAT304	Mathematical Modelling and Numerical Simulation	Mathematics
3	20PHY303	Thin Film Technology and its Applications	Physics
4	20CHE303	Introduction to Nano Science and Technology	Chemistry
5	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
6	20CE304	Green Building and Energy Conservation	Civil
7	20CE305	Environmental Engineering	Civil
8	20ME303	Internet of Manufacturing Things	Mechanical
9	20ME304	Total Quality Management	Mechanical
10	20ME305	Entrepreneurship	Mechanical
11	20EEE303	Robotics	EEE
12	20EEE304	Electrical Safety	EEE
13	20CSE304	Mobile Application Development	CSE
14	20CSE305	Distributed and Cloud Computing	CSE
Any new Interdisciplinary Course offered can be appended in future			

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

ANNEXURE - III

List of Professional Elective – ECE

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE401	Nano Electronics
2.	20ECE402	Electronics Packaging and Testing
3.	20ECE403	Bio-Medical Electronics
4.	20ECE404	Internet of Things
5.	20ECE405	Embedded Systems
6.	20ECE406	Advanced Digital System Design using Verilog HDL
Any advanced courses can be appended in future.		

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

Sl. No.	**Course Code**	**Course Title**
1.	20ECE4M01	Foundations of Cryptography
2.	20ECE4M02	Semiconductor Opto-Electronics
3.	20ECE4M03	Computer Networks and Internet Protocol
4.	20ECE4M04	Computer Architecture
5.	20ECE4M05	Computer Architecture and Organization
6.	20ECE4M06	Communication Networks
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE407	Fiber Optic Communication
2.	20ECE408	Software for Embedded systems
3.	20ECE409	Wireless Communication
4.	20ECE410	FPGA based System Design
5.	20ECE411	Pattern Recognition and its Applications
6.	20ECE412	Cognitive Radio
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE413	Information Theory and Coding
2.	20ECE414	Mobile Communication Networks
3.	20ECE415	RADAR Engineering
4.	20ECE416	Speech and Audio Processing
5.	20ECE417	DSP Architecture
Any advanced courses can be appended in future.		

Professional Elective –V		
Sl. No.	**Course Code**	**Course Title**
1	20ECE418	Digital Image and Video Processing
2	20ECE419	Introduction to MEMS
3	20ECE420	Satellite Communication
4	20ECE421	Error Correcting Codes
5	20ECE422	RFICs
Any advanced courses can be appended in future.		

ANNEXURE - IV

List of Skill Oriented Courses

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

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

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

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

Skill Oriented Course – V		
Sl. No.	**Course Code**	**Course Title**
1.	20ECE609	Digital Signal Processor
2.	20ECE610	Computer Networks
3.	20ECE611	Antenna Design
Any Courses can be appended in future.		

Annexure V

Minor in Electronics and Communication Engineering

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

Stream Name: Communication Systems (CS)

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

Minor in Electronics & Communication Engineering

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

Stream Name: Embedded Systems (ES)

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

Annexure VI

Honors in Electronics & Communication Engineering

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

I YEAR I SEMESTER

B. Tech I Year I Semester

20ENG101 PROFESSIONAL ENGLISH

L	T	P	C
3	0	0	3

Pre-requisite: None

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

Course Objectives: This course enables the student to –

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

UNIT I GRAMMAR & VOCABULARY 9 hours

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

UNIT II READING SKILLS & WRITTEN COMMUNICATION 9 hours

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

UNIT III VERBAL & NON-VERBAL ASPECTS 9 hours

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

UNIT IV CONVERSATIONS 9 hours

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

UNIT V BUSINESS ENVIRONMENT & ETIQUETTES 9 hours

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

Course Outcomes:

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

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

Text Books:

1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference Books:

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

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

B. Tech I Year I Semester

20MAT101 ENGINEERING CALCULUS

L	T	P	C
3	1	0	4

Pre-requisite: Mathematics at Intermediate or Equivalent Level

Course Description:

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

Course Objectives: This course enables the student to –

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

UNIT I INTEGRAL CALCULUS 12 hours

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

UNIT II DIFFERENTIAL CALCULUS 12 hours

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

UNIT III SEQUENCE AND SERIES 12 hours

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

UNIT IV MULTIVARIABLE DIFFERENTIAL CALCULUS 12 hours

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

UNIT V MULTIVARIABLE INTEGRAL CALCULUS 12 hours

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

Course Outcomes:

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

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

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

Text Books:

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

Reference Books:

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

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

B. Tech I Year I Semester

20CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

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

Course Description:

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

Course Objectives:

Students will

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

UNIT I IMPURITIES PRESENT IN WATER AND WATER TREATMENT — 9 hours

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

UNIT II PERIODIC PROPERTIES AND ORGANIC REACTIONS — 7 hours

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

UNIT III SPECTROSCOPY — 8 hours

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

UNIT IV THERMODYNAMICS AND ELECTROCHEMISTRY — 11 hours

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

UNIT V ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY — 10 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books

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

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

B. Tech I Year I Semester

20ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

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

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

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

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

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

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

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

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

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

Text Books:

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

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

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

Reference Books:

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

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

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

B. Tech I Year I Semester

20CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	3	3.5

Pre-requisite: None

Course Description:

Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience.

This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts

Course Objectives:

This course enables students to

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

UNIT I: INTRODUCTION 12 hours

Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Data Types - Integers, Strings, Boolean.

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

UNIT II: OPERATORS AND EXPRESSIONS 12 hours

Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow - if, if-elif else, for, while, break, continue, pass.

a) Swapping of two number with and without using temporary variable.
b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:

- For code '+', perform addition.
- For code '-', perform subtraction.
- For code '*', perform multiplication.
- For code '/', perform division.

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

consonants present in his/her name.

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

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

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

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

UNIT-III: DATA STRUCTURES 12 hours

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

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

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

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

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

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

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

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

Keys	Values
Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

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

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

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

UNIT-IV:

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

Files and Directories:

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

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

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

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

e) Write a Python script to display file contents.

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

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

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

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

UNIT-V:

Python packages: Predefined Packages and User-defined Packages, Package Creation.

Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python, Creating Methods in Python

Brief Tour of the Standard Library: Turtle

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

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

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

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

Course Outcomes:

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

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

Text Books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

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

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.

3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.

5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite Basic Chemistry at Intermediate or equivalent level.

Course Description:

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

Course Objectives:

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

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

LIST OF EXPERIMENTS

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

Course Outcomes:

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

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

Textbook:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.

3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.
4. A Textbook on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Pre-requisite None

Course Description:

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

Course Objectives:

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

LIST OF TRADES

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

Course Outcomes:

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

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

Suggested Text/Reference Books:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

I YEAR II SEMESTER

B. Tech I Year II Semester

20MAT107 LINEAR ALGEBRA, COMPLEX VARIABLES AND ORDINARY DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre-requisite: **20MAT101**

Course Description:

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

Course Objectives:

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

UNIT I MATRICES **9 hours**

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

UNIT II COMPLEX VARIABLE - DIFFERENTIATION **9 hours**

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

UNIT III COMPLEX VARIABLE - INTEGRATION **9 hours**

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

UNIT IV FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS **9 hours**

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

UNIT V ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS **9 hours**

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

Course Outcomes:

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

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

Text Books:

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

Reference Books

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

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

B. Tech I Year II Semester

20PHY102 APPLIED PHYSICS

L	T	P	C
3	1	0	4

Pre-requisite: Plus two level physics course

Course Description:

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

Course Objectives:

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

UNIT I WAVES AND OSCILLATIONS 11 hours

Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures.

Transverse waves, one dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT II OPTICS 13 hours

Superposition of waves, interference of light by division of wavefront - Young's double slit experiment, interference of light by division of amplitude- interference in thin film by reflection, Newton's rings experiment.

Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (Nslit).

Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol's prism. Half wave and Quarter wave plates.

UNIT III QUANTUM MECHANICS 12 hours

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

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 12 hours

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

UNIT V LASERS & FIBER OPTICS 12 hours

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

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

Course Outcomes:

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

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

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics –K. Thyagarajan, McGraw Hill Publishers.

Reference Books:

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

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

B. Tech I Year II Semester

20EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

Pre-requisite: Intermediate Physics

Course Description:

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

Course Objectives:

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

UNIT I DC CIRCUIT ANALYSIS 12 hours

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

UNIT II AC CIRCUIT ANALYSIS 12 hours

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

UNIT III MAGNETIC MATERIALS AND TRANSFORMERS 12 hours

Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV DC AND AC MACHINES 12 hours

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

UNIT V RECTIFIERS AND ELECTRICAL INSTALLATIONS 12 hours

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

Course Outcomes:

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

1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

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

Reference Books:

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

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

B. Tech I Year II Semester

20CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101

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

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

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours

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

UNIT II FUNCTIONS & ARRAY 9 hours

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

UNIT III STRINGS & POINTERS 9 hours

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

UNIT IV STRUCTURES & FILES 9 hours

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

UNIT V DATA STRUCTURES 12 hours

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

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

Text Books:

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

Reference Books:

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

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

B. Tech I Year II Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY

(Common to all branches)

L	T	P	C
0	0	2	1

Pre-requisite: None

Course Description:

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

Course Objectives:

This course enables the student to –

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

Course contents:

Greeting and Introductions (L & S)

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

Describing: (L, S, R & W)

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

Narrating (L, S, R & W)

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

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

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

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

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

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

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

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

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

Course Outcomes:

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

Text Books:

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

References:

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Description:

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

Course Objectives:

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

LIST OF EXPERIMENTS:

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

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

Course Outcomes:

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

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

Reference Books:

1. Physics Laboratory Manual.
2. Optics, A. Ghatak, 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

20EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:

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

Course Objectives:

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

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

DEMONSTRATIONS:

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

EXPERIMENTS:

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: 20CSE101

Course Description:

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

Course Objectives:

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

LIST OF EXPERIMENTS

1. a) Write a C program to swap the two numbers.
b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:
i. Marks in Maths >=65
ii. Marks in Physics >=55
iii. Marks in Chemistry>=50
OR
iv. Total in all three subject >=180

2. a) Write a C program to compute the factorial of a given number.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.

3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.

4. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C program to generate Tribonacci numbers in the given range.

5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.

6. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the corresponding operation given below;
a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication

7. Implement the following sorting techniques.
a) Bubble sort b) Insertion sort c) Selection sort.

8. Implement the following searching techniques.
a) Linear Search b) Binary Search

9. a) Write a program in C to find the frequency of characters in a string.
b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.

10. a) Write a C program to get *N* elements in an array and sort it using Pointer.
b) Write a C program to swap two integers using pass by reference.
c) Write a C program to find the largest element using Dynamic Memory Allocation.

11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.
b) Write a C program to print all permutations of a given string using pointers.
12. a) Write a C program to add two distances in the inch-feet system using structures.
b) Write a C program to calculate difference between Two Time Periods (in *Hours*, *Minutes*, *Seconds* format) using structures.
13. Develop an application to match parenthesis of a given expression using Stack.
14. Develop an application to identify Palindrome string using Stack and Queue.
15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

II Year I Semester

B. Tech II Year I Semester

20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

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

Course Objectives:

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

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

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

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

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

UNIT I DEMAND ANALYSIS 9 hours

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

UNIT II PRODUCTION AND COST ANALYSIS 9 hours

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

UNIT III MARKET STRUCTURE AND PRICING 9 hours

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

UNIT IV BASICS OF ACCOUNTING 9 hours

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

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 9 hours

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

Course Outcomes:

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

1. Understand Engineering economics basic concepts,

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

3. Compare different market structures and identify suitable market,

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

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

Text Books:

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

Reference Books:

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

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

B. Tech II Year I Semester

20MAT113 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre-requisite 20MAT101, 20MAT107

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I LAPLACE TRANSFORMS 9 hours

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

UNIT II FOURIER TRANSFORMS 9 hours

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

UNIT III Z – TRANSFORMS 9 hours

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

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 hours

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

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 hours

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

Course Outcomes:

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

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

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

Text Books:

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

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

Reference Books:

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

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

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

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

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

B. Tech II Year I Semester

20ECE101 NETWORK THEORY

L	T	P	C
2	1	0	3

Pre-requisite **20EEE101**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I NETWORK THEOREMS 9 hours

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

UNIT II RESONANCE 9 hours

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

UNIT III APPLICATION OF LAPLACE TRANSFORM TO ELECTRIC CIRCUITS 9 hours

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis,

Analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT IV TWO PORT NETWORKS 9 hours

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

UNIT V FILTER DESIGN 9 hours

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

Course Outcomes:

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

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

Text Books:

1. Sudhakar, A and Shyammohan S. Palli., "Circuits and Networks, Analysis and Synthesis", McGraw-Hill Education India Pvt. Ltd, 5th Edition, 2010

2. Van Valkenburg, "Network Analysis", Pearson Education, 3rd Edition, 2011.

Reference Books:

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

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

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

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

B. Tech II Year I Semester

20ECE102 DIGITAL SYSTEM DESIGN

L	T	P	C
2	1	0	3

Pre-requisite **20EEE101**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I LOGIC SIMPLICATION 9 hours

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

UNIT II COMBINATIONAL LOGIC DESIGN 9 hours

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

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

UNIT III SEQUENTIAL LOGIC DESIGN 9 hours

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

UNIT IV LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES 9 hours

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

UNIT V VLSI DESIGN FLOW 9 hours

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

Course Outcomes:

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

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

Text Book(s)

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

Reference Books

1. Hall, D V, "Digital Circuits and Systems", Tata McGraw Hill, 1989.
2. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", Prentice Hall of India Pvt. Ltd., 2nd edition, 2003.

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

B. Tech II Year I Semester

20ECE103 ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20EEE101**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I FUNDAMENTALS OF SEMICONDUCTORS 9 hours

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

UNIT II SEMICONDUCTOR DIODES 9 hours

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

UNIT III TRANSISTORS 9 hours

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

UNIT IV APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

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

Transistor amplifiers: BJT and MOS amplifiers

UNIT V LOW FREQUENCY ANALYSIS OF TRANSISTOR AMPLIFIERS **9 hours**

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

B. Tech II Year I Semester

20ECE201 NETWORKS AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

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

2. Verification of Superposition and Reciprocity Theorem.

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

4. Verification of Miller Theorem and Millman's Theorem

5. Verification of Tell Egan's Theorem

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

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

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

9. sign and analyse (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases:

i) $\zeta = 1$ (critically damped system)

ii) $\zeta = 1$ (critically damped system)

iii) $\zeta < 1$ (Under damped system)

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

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

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

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

20ECE202 DIGITAL SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20EEE201**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

PART A: EXPERIMENT USING 74 xx ICs

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

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

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

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

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

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

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

8. Analysis of Decade counters using IC 74x90.

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

PART B: EXPERIMENTS USING XILINX TOOL

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

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

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

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

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

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

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

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

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

20ECE203 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20EEE201

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

Part-A (Hardware)

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

Part-B (Simulation)

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech. II Year I Semester

20HUM901 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite NIL

Course Description:

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

Course Objectives:

The course is intended to:

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

UNIT I INTRODUCTION **6 hours**

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

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

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

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

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

UNIT IV CONSTITUTION FUNCTIONS **6 hours**

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

UNIT V INDIAN SOCIETY **6 hours**

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

Course Outcomes:

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

1. Understand the functions of the Indian government; and

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

Text Books:

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

Reference Books:

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

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

II Year II Semester

B. Tech II Year II Semester

20MAT109 PROBABILITY THEORY AND STOCHASTIC PROCESSES

L	T	P	C
3	0	0	3

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

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I PROBABILITY AND RANDOM VARIABLES 9 hours

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

UNIT II ONE DIMENSIONAL RANDOM VARIABLE 9 hours

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

UNIT III MULTIPLE RANDOM VARIABLES 9 hours

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

UNIT IV TRANSFORMATION OF RANDOM VARIABLES AND RANDOM SEQUENCES 9 hours

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

UNIT V RANDOM PROCESSES 9 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

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

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

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

B. Tech II Year II Semester

20ECE104 CONTROL SYSTEMS ENGINEERING

L	T	P	C
2	1	0	3

Pre-requisite **20ECE101**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I CONTROL SYSTEMS - MODELLING AND REPRESENTATION 9 hours

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

UNIT II TIME DOMAIN ANALYSIS 9 hours

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

UNIT III STABILITY ANALYSIS AND CONTROLLER DESIGN 9 hours

Concept of system stability, Routh-Hurwitz stability criterion, Relative stability, Concept of root locus and its procedure. Introduction to compensator and controllers, Lead and lag compensator, P, PI and PID control actions

UNIT IV FREQUENCY DOMAIN ANALYSIS 9 hours

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

UNIT V MODERN CONTROL THEORY 9 hours

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

B. Tech II Year II Semester

20ECE105 PRINCIPLES OF SIGNALS AND SYSTEMS

L	T	P	C
2	1	0	3

Pre-requisite **20MAT101**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS 9 hours

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

UNIT II LINEAR TIME INVARIANT (LTI) SYSTEMS 9 hours

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

UNIT III FOURIER ANALYSIS FOR PERIODIC AND APERIODIC SIGNALS 9 hours

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

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

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

signals, properties of Laplace transform, properties of region of convergence. Inverse Laplace transform, Laplace domain analysis of continuous time LTI system.

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

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

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

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

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

B. Tech II Year II Semester

20ECE106 ANALOG CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103**

Course Description:

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

Course Objectives:

This course enables students to

1. Study the basics of differential amplifiers.
2. Understand the basics of feedback amplifiers and oscillators.
3. Realize the basic operations and configurations of operational amplifiers.
4. Design and develop the important applications of operational amplifier
5. Study special function ICs and its applications.

UNIT I DIFFERENTIAL AND POWER AMPLIFIERS 9 hours

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

UNIT II FEEDBACK AMPLIFIERS AND OSCILLATORS 9 hours

Feedback amplifiers: Basics of feedback, positive and negative feedback. Properties of negative feedback, Feedback topologies, series-shunt, shunt-series, series-series, shunt-shunt. Analysis of feedback voltage amplifiers.

Oscillators: Barkhausen criteria, RC oscillators: Phase-shift and Wien bridge oscillators, LC oscillators: Hartley and Colpitts oscillators, Crystal oscillator.

UNIT III OPERATIONAL AMPLIFIERS 9 hours

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

UNIT IV APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

Log and antilog amplifiers, Comparators, Schmitt trigger and derivation of the hysteresis voltage. Active filters: low-pass, high-pass, band-pass, band-stop and all-pass filters. Precision rectifiers: Half-wave and full wave. Instrumentation amplifiers

UNIT V SPECIAL FUNCTION ICs 9 hours

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

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

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

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

B. Tech II Year II Semester

20ECE107 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

Pre-requisite 20ECE102

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I 8086 MICROPROCESSORS 9 hours

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

UNIT II INTERFACING WITH 8086 9 hours

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

UNIT III 8051 MICROCONTROLLERS 9 hours

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

UNIT IV ARM MICROCONTROLLER 9 hours

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

UNIT V APPLICATION PROGRAMMING 9 hours

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books:

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

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

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

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

B. Tech II Year II Semester

20ECE204 SIMULATION AND CONTROL LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE101**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

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

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

20ECE205 ANALOG CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE103**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

Design and Implementation of the following Circuits using Hardware and Multisim

1. ıdy of voltage feedback amplifiers and trans-conductance amplifiers

2. ısign and implementation of differential and summing amplifier using op-amps

3. ısign and test inverting and non-inverting amplifiers using op-amps

4. easurement of input offset voltage, input bias current and input offset current, slew rate of op-amp

5. ısign and test RC phase-shift oscillator and Wien bridge oscillator

6. ısign and test Hartley oscillator and Colpitts oscillator

7. ısign and implementation of active LPF, HPF and band-pass filter

8. ısign and test integrator and differentiator circuits using op-amp

9. easurement of gain of instrumentation amplifier using op-amp

10. ısign and test astable and monostable multivibrators using 555 timers

11. ıltage regulator using IC 78XX, IC 79XX, IC 723

12. ımparator and Schmitt trigger circuit using op-amp

Course Outcomes:

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

1. Measure input offset voltage, slew rate of op-amp
2. Design and implement various applications of op-amp
3. Design and implement astable and monostable multivibrator using 555 timers
4. Implement Fixed and adjustable voltage regulator
5. Implement above circuits using MULTISIM Tool

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester

20ECE206 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	3	1.5

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

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

8086 Microprocessor Experiments:

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

8051 Microcontroller Experiments:

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

ARM Microcontroller Experiments:

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech. II Year II Semester

20CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

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

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

Course Objectives:

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

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES — 6 hours

Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

UNIT II ECOSYSTEMS — 6 hours

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

UNIT III BIODIVERSITY AND ITS CONSERVATION — 6 hours

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

UNIT IV ENVIRONMENTAL POLLUTION — 6 hours

Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 6 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

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

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

III Year I Semester

B. Tech III Year I Semester

20ECE108 ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

L	T	P	C
2	1	0	3

Pre-requisite 20MAT101, 20PHY102

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I ELECTROSTATICS **9 hours**

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

UNIT II MAGNETOSTATICS **9 hours**

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

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

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

UNIT IV TRANSMISSION LINES **9 hours**

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

UNIT V TRANSMISSION ANALYSIS 9 hours

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

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

Course Outcomes:

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

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

Text Book(s)

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

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

Reference Books

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

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

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

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

B. Tech III Year I Semester

20ECE109 ANALOG COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE105**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I RANDOM PROCESS FOR COMMUNICATION 9 hours

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

UNIT II AMPLITUDE MODULATION SYSTEMS 9 hours

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

UNIT III ANGLE MODULATION SYSTEMS 9 hours

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

UNIT IV ANALOG PULSE MODULATION SCHEMES 9 hours

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

UNIT V INFORMATION THEORY & CHANNEL CAPACITY 9 hours

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

Course Outcomes:

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

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

Text Book(s)

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

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

Reference Books

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

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

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

B. Tech III Year I Semester

20ECE110 DIGITAL SIGNAL PROCESSING

L	T	P	C
2	1	0	3

Pre-requisite 20ECE105

Course Description:

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

Course Objectives:

This course enables students to

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

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

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

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

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

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

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

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

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

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

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

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

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

UNIT IV DIGITAL SIGNAL PROCESSOR 9 hours

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

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

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9 hours

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

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

Course Outcomes:

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

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

Text Book(s)

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

Reference Books

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

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

B. Tech III Year I Semester

20ECE207 ANALOG COMMUNICATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS:

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

20ECE208 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

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

DSP PROCESSOR BASED IMPLEMENTATION

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech III Year I Semester

20HUM902 / 20HUM102* UNIVERSAL HUMAN VALUES

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

Pre-requisite None.

Course Description:

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

Course Objectives:

This course enables students to

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

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

L1: Purpose and motivation for the course, recapitulation from Universal Human Values-I

L2: Self-Exploration–what is it? - Its contentand process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

L3: Continuous Happiness and Prosperity- A look at basic Human Aspirations

L4: Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

L5: Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

L6: Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

T1 & T2: Discussion on natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

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

L7: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

L8: Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

L9: Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

L10: Understanding the characteristics and activities of 'I' and harmony in 'I'

L11: Understanding the harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

L12: Programs to ensure Self-regulation and Health.

T3 & T4: Discussion on the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT III Understanding Harmony in the Family and Society 7 hours

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

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

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

UNIT IV Understanding Harmony in the Nature and Existence 6 hours

L18: Understanding the harmony in the Nature
L19: Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
L20: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
L21: Holistic perception of harmony at all levels of existence.
T7 & T8: Discussion on human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

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

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

Course Outcomes:

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

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

Text Book(s)

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

Reference Books

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

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

III Year II Semester

B. Tech III Year II Semester

20ECE111 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

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

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

Course Outcomes:

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

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

Text Book(s)

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

Reference Books

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

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

B. Tech III Year II Semester

20ECE112 ANTENNA AND MICROWAVE ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite 20ECE108

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I INTRODUCTION TO ANTENNA THEORY 9 hours

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

UNIT II ANTENNA ARRAYS 9 hours

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

UNIT III INTRODUCTION TO MICROWAVE ENGINEERING 9 hours

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

UNIT IV MICROWAVE DEVICE DESIGN 9 hours

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

UNIT V MICROWAVE NETWORK ANALYSIS AND MICROWAVE MEASUREMENTS 9 hours

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

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

Course Outcomes:

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

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

Text Book(s)

1. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley,4th edition, February 2016
2. Microwave Engineering, M. Pozar, Willey & Sons Inc. 4th Edition, 2011

Reference Books

1. Microwave Devices and Circuits, Samuel Y. Lio , Pearson, 3rd edition, 2003
2. J.D. Kraus, Antennas, McGraw Hill,3rd edition 2001.
3. Microwave Engineering, A Das & S Das. Mc Graw Hill, 3rd Edition, 2017
4. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005.
5. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985

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

B. Tech III Year II Semester

20ECE113 DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **20ECE109**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I CONVERSION OF ANALOG WAVEFORMS INTO CODED PULSES — 9 hours

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

UNIT II DIGITAL BASEBAND TRANSMISSION AND RECEPTIONS — 9 hours

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

UNIT III DIGITAL BANDPASS TRANSMISSION AND RECEPTION — 9 hours

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

UNIT IV PERFORMANCE ANALYSIS OF DIGITAL BANDPASS SYSTEMS **9 hours**

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

UNIT V EQUALIZATION AND CARRIER RECOVERY TECHNIQUES **9 hours**

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

Course Outcomes:

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

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

Text Book(s)

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

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

Reference Books

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

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

B. Tech III Year II Semester

20ECE209 VLSI DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE102**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

Part I: Digital System Design using HDL & FPGA

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

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

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

Part-II: Digital Circuit Design

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

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

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

Part-III Analog Circuit Design

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

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

20ECE210 MICROWAVE ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20ECE108, 20ECE112

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS

Hardware Experiments

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

Simulation Experiments

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

20ECE211 DIGITAL COMMUNICATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20ECE105**

Course Description:

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

Course Objectives:

This course enables students to

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

LIST OF EXPERIMENTS:

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

Course Outcomes:

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

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

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course
B. Tech III Year II Semester

20CE901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Pre-requisite **None**

Course Description:

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

Course Objectives:

This course enables students to

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

UNIT I INTRODUCTION **6 hours**

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

UNIT II TYPES OF DISASTERS **6 hours**

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

UNIT III DISASTER IMPACTS **6 hours**

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

UNIT IV DISASTER RISK MITIGATION MEASURES **6 hours**

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

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 6 hours

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

Course Outcomes:

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

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

Text Book(s)

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

Reference Books

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/%20(National%20Disaster%20management%20in%20India,%20Ministry%20of%20Home%20Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments and Mid Term Tests

Open Elective - II

Open Elective - II

20MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

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

Course Description:

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

Course Objectives:

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

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS — 9 hours

Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial - Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.

Exercises of Bisection method and Newton's method through MATLAB

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS — 9 hours

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

UNIT III INTERPOLATION & NUMERICAL CALCULUS — 9 hours

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

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS — 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.

Exercises of Runge-Kutta method and Shooting method through MATLAB.

UNIT V NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS **9 hours**

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

Course Outcomes:

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

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

Text Books:

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

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43^{rd} edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7^{th} ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10^{th} ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3^{rd} 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., 5^{th} Edition, 2010.

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

Open Elective - II

20MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

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

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

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

UNIT I CLASSICAL OPTIMIZATION **9 hours**

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

UNIT II LINEAR PROGRAMMING PROBLEM **9 hours**

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

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM **9 hours**

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

UNIT IV DYNAMIC PROGRAMMING **9 hours**

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

UNIT V PROJECT MANAGEMENT AND QUEUING MODELS **9 hours**

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

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

Text Books:

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

Reference Books

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

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

Open Elective - II

20PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

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

Course Objectives:
Students will

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

UNIT I INTRODUCTION 9 hours

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

UNIT II ABERRATIONS AND OPTICAL INSTRUMENTS 9 hours

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

UNIT III WAVE OPTICS & INTERFERENCE 9 hours

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

UNIT IV DIFFRACTION & POLARISATION 9 hours

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

UNIT V FIBER OPTICS 9 hours

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

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

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

Text Books:

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

Reference Books

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).

2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

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

Open Elective – II

20PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

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

Course Description:

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

Course Objectives:

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

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

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

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules; Atomic lasers: He-Ne laser, Argon Ion laser; Molecular Lasers: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.

Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours

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

Course Outcomes:

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

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

Text Books:

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

Reference Books

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

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

Open Elective - II

20CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

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

Course Description:

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

Course Objectives:

Students will

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

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

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

UNIT II CHEMICALS AND THEIR IMPORTANCE IN PETROLEUM INDUSTRY — 9 hours

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

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

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

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

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

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

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

Course Outcomes:

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

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

Text Books:

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

Reference Books

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

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

Open Elective – II

20CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

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

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

Course Objectives:
Students will

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

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

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

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

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

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

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

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and

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

Course Outcomes:

Upon completion of this course the students should:

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

Text Books:

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

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

Reference Books

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

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

Open Elective – II

20CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

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

Course Objectives:

Students will

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

UNIT I DEWATERING & GROUTINHG 9 hours

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

UNIT II DENSIFICATION 9 hours

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

UNIT III STABILIZATION 9 hours

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

UNIT IV REINFORCED EARTH & GEOSYNTHETICS 9 hours

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

UNIT V EXPANSIVE SOILS 9 hours

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

Course Outcomes:

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

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

Text Books:

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

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

Reference Books

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

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

Open Elective – II

20CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

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

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

UNIT I CONCEPTS AND METHODOLOGIES IN EIA 9 hours

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

UNIT II IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

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

UNIT III IMPACT ON VEGETATION AND WILD LIFE 9 hours

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

UNIT IV ENVIRONMENTAL AUDIT 9 hours

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

UNIT V ENVIRONMENTAL POLLUTION ACTS 9 hours

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

Course Outcomes:
The students after completing the course will be able to:
1. Apply the various methods used in predicting environmental impacts.
2. Apply site information to interpret impacts on land and groundwater.
3. Evaluate environmental impacts of various development activities on existing ecosystem.
4. Apply the procedures and various protocols involved in preparation of environmental audit report.
5. Apply the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books:

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

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers

2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication, New Delhi.

3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

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

Open Elective – II

20CE303 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

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

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

UNIT I CONCEPT OF WATERSHED 9 hours

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

UNIT II WATERSHED MODELING 9 hours

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

UNIT III EROSION AND SEDIMENTATION 9 hours

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

UNIT IV WATER HARVESTING 9 hours

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

UNIT V COVER MANAGEMENT 9 hours

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

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

Course Outcomes:

The students after completing the course will be able to:

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

Text Books:

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

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

Open Elective – II

20ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

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

UNIT I STRUCTURE OF MATERIALS 9 hours

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

UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours

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

UNIT III ELECTRICAL PROPERTIES OF MATERIALS 9 hours

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

UNIT IV MAGNETIC PROPERTIES OF MATERIALS 9 hours

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

UNIT V PHOTONIC MATERIALS 9 hours

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

Course Outcomes:

At the end of the course students will be able:

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

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

Text Books:

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

Reference Books

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

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

Open Elective – II

20ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

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

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

UNIT I THERMODYNAMICS 9 hours

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

UNIT II BOILERS, TURBINES AND PUMPS 9 hours

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles, and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

UNIT III IC ENGINES AND REFRIGERATION SYSTEMS 9 hours

Internal Combustion Engines: Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle. Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

UNIT IV MATERIALS, CASTING AND TRANSMISSION 9 hours

Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.

Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.

Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.

UNIT V TOOLS AND MANUFACTURING SYSTEMS 9 hours

Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.

Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control.

Course Outcomes:

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

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Books:

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

Reference Books

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017

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

Open Elective – II

20EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

UNIT I ELECTRICAL SYSTEM COMPONENTS 9 hours

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9 hours

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III ILLUMINATION SYSTEMS 9 hours

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

UNIT IV INDUSTRIAL SUBSTATION SYSTEMS 9 hours

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V INDUSTRIAL SYSTEM AUTOMATION 9 hours

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Course Outcomes:

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

1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.
3. https://www.bis.gov.in/

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

Open Elective – II

20EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:

1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I INTRODUCTION 9 hours

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

UNIT II MICRO SENSORS & ACTUATORS 9 hours

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING 9 hours

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS 9 hours

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS 9 hours

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

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

1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. Analyze the Micro sensors and actuators and its fabrication.
3. Explain the materials for MEMS and Microsystems.
4. Design MEMS using microfabrication techniques.
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Books:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,’Micro and Smart Systems’, Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

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

Open Elective – II

20CST301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101, 20CSE102

Course Description:
Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, and input/output management.

Course Objectives:

1. To understand the basic concepts and functions of operating systems
2. To understand Processes and Threads
3. To analyze Scheduling algorithms
4. To understand the concept of Deadlocks
5. To analyze various memory management schemes
6. To understand I/O management and File systems

UNIT I OPERATING SYSTEMS OVERVIEW 9 hours

Operating system overview: Objectives – functions - Computer System Organization-Operating System Structure - Operating System Operations- System Calls, System Programs.

UNIT II PROCESS MANAGEMENT 9 hours

Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication. Process Synchronization: The Critical-Section Problem - Semaphores - Classic Problems of Synchronization – Monitors. Case Study: Windows 10 operating system

UNIT III SCHEDULING AND DEADLOCK MANAGEMENT 9 hours

CPU Scheduling: Scheduling Criteria - Scheduling Algorithms. Deadlocks: Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock. Case Study: MAC operating system

UNIT IV STORAGE MANAGEMENT 9 hours

Main Memory: Swapping - Contiguous Memory Allocation, Segmentation, Paging. Virtual Memory: Demand Paging - Page Replacement - Allocation of Frames - Thrashing. Case Study: Android operating system

UNIT V MASS STORAGE MANAGEMENT 9 hours

Mass Storage Structure: Disk Structure - Disk Scheduling - Disk Management. File-System Interface: File Concepts, Directory Structure - File Sharing – Protection. File System. Case Study: Linux operating system

Course Outcomes:

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

1. Understand operating system program, structures and operations with system calls.
2. Apply the process management concept for real time problems
3. Illustrate CPU scheduling algorithms and to handle the deadlock for the given situation.
4. Explain the concepts of various memory management techniques
5. Summarize the storage concepts of disk and file.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2020.

2. Richard Petersen, "Linux: The Complete Reference", 6th Edition, Tata McGraw-Hill, 2008

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.

2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

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

Open Elective – II

20CSE301 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

Pre-requisite: **None**

Course Description:
Basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java-classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:
1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
3. To Introduce the implementation of packages and interfaces.
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

UNIT I INTRODUCTION TO OOPS CONCEPTS AND CLASSES 9 hours

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements.
Classes: Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, Polymorphism
Arrays: One Dimensional and multi-dimensional arrays.

UNIT II STRINGS, INHERITANCE, INTERFACES, AND PACKAGES 9 hours

Strings: Strings, String Handling - Inheritance: Basics, Usage of Super, Multi-level hierarchy, Method overriding, Abstract class, Final keyword. - Interfaces: Creating, Implementing, Using, Extending, and Nesting of interfaces - Packages: Defining, Finding and Importing packages, Member Access.

UNIT III EXCEPTION HANDLING &MULTI-THREADING 9 hours

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.
Multi-threading: Thread Class, Runnable interface, creating multiple threads, life cycle of thread, thread properties, synchronization, thread communication, suspending, resuming and stopping threads.

UNIT IV I/O STREAMS AND COLLECTION FRAME WORK CLASSES 9 hours

I/O Streams: Byte Stream Classes and Character Stream Classes.
Collection Frame work : Hierarchy of collection framework, Array-List, Linked-List, Vector, Stack, Queue, Priority Queue, Hash Set, Linked Hash Set, Tree Set.

UNIT V GUI PROGRAMMING AND EVENT HANDLING 9 hours

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Event Handling-Handling mouse and keyboard events, Exploring Swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables. JDBC: Connecting to Database, querying a database and processing the results, updating data with JDBC.

Course Outcomes:

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

1. Choose object-oriented programming concepts for problem solving.
2. Create and use packages and interfaces.
3. Develop multithreaded applications with synchronization.
4. Provide computed based solutions by using java collection framework and I/O classes.
5. Design GUI based applications.

Text Books:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books

1. Core Java Volume I – Fundamentals, by Cay S. Horstmann, Gary Cornell Pearson Education Ninth Edition
2. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
3. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
4. "Thinking in Java", Bruce Eckel, Pearson Education.
5. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

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

Open Elective – II

20CSE302 MULTIMRDIA TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course aims to introduce the students to Multimedia technologies and their usage in real world applications. This course covers introduction to multimedia, different image, video and audio formats, image coding and compression techniques, I/O technologies, Multimedia network and Multimedia Security and Forensics.

Course Objectives:
1. To provide the foundation knowledge of multimedia technologies.
2. To provide the knowledge about media characteristics, compression standards, multimedia representation, data formats, multimedia technology development.
3. To understand Multimedia security and forensics.
4. To understand multimedia components efficiently
5. To develop integrated, collaborative multimedia systems

UNIT I INTRODUCTION **9 hours**

Introduction to Multimedia: Multimedia Elements – Multimedia applications – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Multimedia Architecture – Multimedia Documents

UNIT II COMPRESSION, ANIMATION , FILE FORMATS **9 hours**
Compression, Decompression, Binary Image Compression Schemes, Types of Compression, Image Compression, Video Compression, Audio Compression. Principles of animation, 2D, 3D animation.
File formats: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format.

UNIT III MULTIMEDIA TECHNOLOGIES **9 hours**
Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images – Full Motion Video -Video Motion Analysis.

UNIT IV MULTIMEDIA PROTOCOLS **9 hours**
Protocol - QOS Issues - RTP, RTCP, RTSP, SIP - Media on demand –ITV - STB Broadcast Schemes for VoD Buffer Management- Multimedia over wireless networks.

UNIT V SECURITY ATTACKS **9 hours**
Multimedia encryption - Digital Watermarking. Security Attacks- Digital Forensics taxonomy, goals/requirements - Forensic Data Acquisition -Forensics Analysis and Validation.

Course Outcomes:

Upon completion of this course, students should be able to

1. Understand the characteristics of different media and the representations of different multimedia data formats.
2. Understand the characteristics of Image, Audio and Video systems and takes into considerations in multimedia techniques design and implementation.
3. Describe different coding and compression principles and compare different compression techniques.
4. Design multimedia components efficiently
5. Develop integrated, collaborative multimedia system

Text Books:

1. Li, Ze-Nian and Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall of India, 2004.

2. Steinmetz Ralf and K. Nahrstedt "Multimedia: Computing, Communications & Applications",Pearson Education, 1995.

Reference Books

1. Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2009
2. Chun-Shien Lu, "Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property", Springer Inc 2007

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

PROFESSIONAL ELECTIVE-I

Professional Elective – I

20ECE401 NANO ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103, 20ECE108**

Course Description:

This course provides an overview of Semiconductor Physics and carrier transport phenomenon. It illustrates Quantum Mechanics, Nano-materials, Nanoscale MOSFET Transistors and their characteristics.

Course Objectives:

This course enables students to

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

UNIT I INTRODUCTION **9 hours**

Introduction to nanotechnology, meso-structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States.

UNIT II BAND THEORY **9 hours**

Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

UNIT III SHRINK-DOWN APPROACHES **9 hours**

Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

UNIT IV NANO DIODES **9 hours**

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics.

UNIT V APPLICATIONS **9 hours**

Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Course Outcomes:

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

1. Understand various aspects of nano-technology and energy band structure of nanomaterials.
2. Understand the fundamental features of nano-materials and appropriate use in solving practical problems.
3. Understand the operation of semiconductor devices.
4. Understand the band theory of solids and concept of scaling for designing of semiconductor devices.
5. Understand the various applications of nanomaterials.

Text Book(s)

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.

Reference Books

1. K.E. Drexler, Nano systems, Wiley, 1992.

2. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

3. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley,2003

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

Professional Elective – I

20ECE402 ELECTRONICS PACKAGING AND TESTING

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103**

Course Description:

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

Course Objectives:

This course enables students to

1. Know the basic concepts, levels, and applications of Electronic Systems Packaging.
2. Understand the electrical issues in electronic packaging.
3. Study and understand the steps involved in designing chip package.
4. Understand the different levels of manufacturing in PCB
5. Understand the various physical issues considered in testing the chip

UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9 hours

Functions of an electronic package, Packaging hierarchy, Packaging aspects of handled products-MEMS packaging, Medical electronics packaging, Packaging trends and challenges, Driving forces on packaging technology, Materials for Microelectronic packaging, Packaging material properties, Material for high density interconnect substrate, Wafer fabrication.

UNIT II ELECTRICAL ISSUES IN PACKAGING 9 hours

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitic.

UNIT III CHIP PACKAGES 9 hours

IC Assembly – Purpose and requirements, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded.

UNIT IV PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9 hours

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.

UNIT V TESTING 9 hours

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

Course Outcomes:

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

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

Text Book(s)

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.

2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.

Reference Books

1. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.

2. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

3. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005.

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

Professional Elective – I

20ECE403 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE103, 20ECE106**

Course Description:

This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:

This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

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

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

Course Outcomes:

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

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Book(s)

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.

2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014

2. R.S.Khandpur,"HandbookofBiomedicalInstrumentation",2ndedition,TataMcGraw-Hill, New Delhi, 2005

3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

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

Professional Elective – I

20ECE404 INTERNET OF THINGS

L	T	P	C
3	0	0	3

Pre-requisite 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 **9 hours**

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

UNIT II EMBEDDED DEVICES – I (ARDUINO) **9 hours**

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

UNIT III EMBEDDED DEVICES – II (RASPBERRY PI) **9 hours**

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

UNIT IV COMMUNICATION IN THE IOT **9 hours**

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.

UNIT V PROTOTYPING ONLINE COMPONENTS **9 hours**

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.

Course Outcomes:

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

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application using APIs

Text Book(s)

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.

Professional Elective – I

20ECE405 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE107**

Course Description:

The course will provide strong foundation on embedded system design. The course covers theory and logic to develop programming expertise. Student will understand application of embedded microcontrollers ARM.

Course Objectives:

This course enables students to

1. To provide knowledge on the basics, building blocks of Embedded System.
2. To provide basic of operating system and Real time programming languages
3. To teach automation using scheduling algorithms and Real time operating system.
4. To understand firmware design and Architectural Support for Operating Systems for various applications
5. To discuss on different Phases & Modeling of a new embedded product.

UNIT I THE CONCEPT OF EMBEDDED SYSTEMS 9 hours

Embedded System Design, Introduction to Embedded Hardware Elements, Sensors and Actuators, Embedded Processors, Memory Architectures. Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories, Embedded microcontroller cores

UNIT II SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I 9 hours

Operating System Basics, types of Operating Systems, Task and Task States, Semaphores and shared Data, RTOS services and design using RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Real time programming languages.

UNIT III SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II 9 hours

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS, Integrated Development Environment (IDE).

UNIT IV FIRMWARE AND ARCHITECTURAL SUPPORT FOR OPERATING SYSTEMS 9 hours

Firmware and Bootloader, an introduction to operating systems, The ARM system control coprocessor Embedded ARM Applications, CP15 protection unit registers, CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/Output, Example and exercises, The ARM7500 and ARM7500FE.

UNIT V MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES 9 hours

Modelling embedded systems- embedded software development approach -Overview of UML modelling with UML, UML Diagrams-Hardware/Software Partitioning, Co-Design Approaches for System Specification and modelling- Co-Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures-design approach on parallelism in uniprocessors & Multiprocessors.

Course Outcomes:

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

1. To understand the functionalities of processor internal blocks, with their requirement
2. Understand the basics of operating systems and then to learn the programming language used for real time operating system.
3. systems and related terms.
4. Understand the role and features of RT operating system, that makes multitask execution possible by processors.
5. Understand that using multiple CPU based on either hard-core or softcore helps data overhead management with processing.

Text Book(s)

1. M.A. Mazdi & J.G. Mazdi, The 8051 Microcontroller and Embedded System, Pearson Education India , 2013
2. Andrew N. Sloss & Dominic Symes, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publisher, 2004.

Reference Books

1. Steve Furber, Arm System-On-Chip Architecture, 2000.
2. J.K. Peckol, Embedded Systems A contemporary Design Tool, Wiley Student Edition , 2008
3. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram International Publishing (India)
4. S. Heath, Embedded Systems Design, Elsevier, 2009

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

Professional Elective – I

20ECE406 ADVANCED DIGITAL SYSTEM DESIGN USING VERILOG HDL

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102**

Course Description:

The course will provide advanced knowledge on combinational and sequential design using Verilog HDL. The course covers theory and methods to develop expertise in the field of Digital Logic Design using Verilog. Student will understand application of advanced digital logic designs in FPGAs and analyze the behaviour through Verilog HDL programming.

Course Objectives:

This course enables students to

1. Understand the digital design methodology, and revise the combinational and sequential logic concepts.
2. Program combinational and sequential logic circuits using Verilog HDL.
3. Synthesize combinational and sequential logic circuits.
4. Understand FPGA architectures.
5. Design digital logics in FPGAs

UNIT I **COMBINATIONAL AND SEQUENTIAL LOGIC DESIGN** **9 hours**

Digital Design Methodology; Combinational Circuits: Half Adder, Full Adder, Comparators, Decoders, Encoders, Multiplexers, Parity Generators and Checkers; Data Storage Elements: Latches, Flip-Flops, Register, Memory, ROM, RAM; Sequential Circuits: State Representations, Timing in Sequential Circuits, Shift Registers, Counters.

UNIT II **LOGIC DESIGN WITH VERILOG** **9 hours**

Introduction to Verilog; Gate Level Modelling, Data Flow Modelling, Behavioural Level Modelling, Switch Level Modelling; Digital system design using Verilog HDL.

UNIT III **SYNTHESIS OF COMBINATIONAL AND SEQUENTIAL LOGIC USING VERILOG** **9 hours**

Introduction to Synthesis: Logic Synthesis, RTL Synthesis, High Level Synthesis; Synthesis of Combinational Logic: Synthesis of Priority Structure, Exploiting Logical Don't-Care Conditions, ASIC Cells and Resource Sharing; Synthesis of Sequential Logic: Synthesis of Latches, Flip-flops, State Machines.

UNIT IV INTRODUCTION TO FPGA ARCHITECTURES **9 hours**

Overview, Programming Technologies, Configurable Logic Block, FPGA Routing Architectures.

UNIT V **DESIGNING WITH FPGA** **9 hours**

Design Flow for FPGAs, Prototyping with FPGAs, and Debugging.

Course Outcomes:

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

1. Design a combinational and sequential circuits.
2. Understand the basics of Verilog and can design any combinational and sequential circuits using Verilog HDL.
3. Understand the different Synthesis methods and can synthesize the combinational and sequential circuits.
4. Understand the different FPGA architectures.
5. Implement any digital system on FPGA

Text Book(s)

1. Michael D. Ciletti, "*Advanced Digital Design with Verilog HDL*", PHI, 2005

2. T. R. Padmanabhan and B. Bala Tripura Sundari, "*Design through Verilog HDL*", WSE, IEEE Press, 2004.

Reference Books

1. Cem Unsalan, Bora Tar, "*Digital System Design with FPGA: Implementation Using Verilog and VHDL*", ISBN: 9781259837906, McGraw Hill Publications.
2. Shivakumar S. Chonnad and Needamangalam B. Balachander, "*Verilog: Frequently Asked Questions: Language, Applications, and Extensions*", ISBN: 978-0387228341, Publisher: Springer, 2007.
3. Simon Monk, "*Programming FPGAs-Getting Started with Verilog*", ISBN: 978- 1259643767, McGraw Hill Publications. ISBN: 978-0982497098, LBE Books.
4. Steve Kilts, "*Advanced FPGA Design: Architecture, Implementation, and Optimization*", ISBN: 9780470054376, Publishers: Wiley, 2007
5. Richard C. Dorf and John V. Oldfield, "*Field-Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems*" ISBN: 9788126516612, Publisher: Wiley, 2008.

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

Skill Oriented Course

Skill Oriented Course – I

B.Tech. II Year I Semester

20ENG601 CORPORATE COMMUNICATION

L	T	P	C
1	0	2	2

Pre-requisite: 20ENG201

Course Description:

English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives:

This course enables the students to –

1. Focus on their interactive skills
2. Develop their communicative competency
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I LISTENING SKILLS 8 hours

Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING 10 hours

Articulation of sounds; Intonation.; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations**:** Role play.

UNIT III READING SKILLS 8 hours

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS 9 hours

Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion.
Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.

UNIT V INTERVIEW SKILLS 10 hours

fferent types of interviews: Answering questions and offering information; Mock interviews; Body Language.

Course Outcomes:

At the end of the course, learners will be able to—

1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Text Books:

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference:

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let's Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10. www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

Skill Oriented Course – II
B. Tech II Year II Semester

20ECE601 PYTHON FOR DATA SCIENCE

L	T	P	C
1	0	2	2

Pre-requisite **20CSE101**

Course Description:
This course is designed to equipping students to be able to use python programming for solving data science problems.

Course Objectives:
This course enables students to

1. Train the students in solving computational problems
2. Elucidate solving mathematical problems using Python programming language
3. Understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

UNIT I INTRODUCTION TO NUMPY 6 hours

Introduction to Data Science and its importance - Data Science and Big data-, Establishing computational environments for data scientists using Python with IPython and Jupyter. NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.

- Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions
- Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting
- Computation on NumPy arrays using Universal Functions and Mathematical methods

UNIT II DATA MANIPULATION WITH PYTHON 6 hours

Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format

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- Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
- Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

UNIT III PANDAS DATA STRUCTURES WITH PYTHON 6 hours

Introduction to pandas Data Structures: Series, Data Frame,

- Create Pandas Series and Data Frame from various inputs.

UNIT IV DATA VISUALIZATION WITH PYTHON 6 hours

Function Application and Mapping- Sorting and Ranking, Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots

- Import any CSV file to Pandas Data Frame and perform the following:

(a) Visualize the first and last 10 records
(b) Get the shape, index and column details.
(c) Select/Delete the records(rows)/columns based on conditions.
(d) Perform ranking and sorting operations.
(e) Do required statistical operations on the given columns.
(f) Find the count and uniqueness of the given categorical values.
(g) Rename single/multiple columns.

- Import any CSV file to Pandas Data Frame and perform the following:

(a) Handle missing data by detecting and dropping/ filling missing values.
(b) Transform data using apply () and map () method.
(c) Detect and filter outliers.
(d) Perform Vectorized String operations on Pandas Series.
(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

UNIT V MACHINE LEARNING USING PYTHON 6 hours

Introduction Machine Learning: Categories of Machine Learning algorithms, Feature Engineering- Naive Bayes Classification - Linear Regression – k-Means Clustering.

- Write a program to demonstrate Linear Regression analysis with residual plots on a given data set.
- Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
- Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Python ML library classes.
- Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Course Outcomes:

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

1. Illustrate the use of various data structures.
2. Analyze and manipulate Data using Numpy and Pandas.
3. Creating static, animated, and interactive visualizations using Matplotlib.
4. Understand the implementation procedures for the machine learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Books:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.

2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

Reference Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.
3. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at https://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
4. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016 4. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Skill Oriented Course – II

B. Tech II Year II Semester

20ECE602 SENSORS AND INSTRUMENTATION

L	T	P	C
1	0	2	2

Pre-requisite: 18EEE101

Course Description:

This course covers the basic Characteristics of various Sensors and Transducers. It gives a brief idea about principle and working of various Resistive Inductive and Capacitive Transducers. The measurement of non-electrical quantities is also dealt with applications and miscellaneous transducers used in industries are also covered.

Course Objectives:

This course enables the students to –

1. Understand the principle and operation of various Bridges
2. Know the characteristics of Resistive Transducers
3. Understand various inductive and capacitive transducers
4. Study various types of signal conditioning circuits and A/D Converters.
5. Study the Characteristics of miscellaneous transducers

UNIT I AC BRIDGES 6 hours

Introduction to Bridges -Wheat Stone Bridge, Kelvin Bridge, Schering Bridge, Anderson's Bridge and Maxwell Bridge.

- Measurement of Low Resistance by Kelvin's Bridge.
- Measurement of Self Inductance using Anderson's Bridge.
- Measurement of Capacitance using Schering Bridge

UNIT II RESISTIVE TRANSDUCERS 6 hours

Strain gauge –Types– Applications – RTD - Temperature Sensors -Thermistors – Thermocouple-Constructions, Load Cell- Characteristics

- Calibration of Strain gauge for strain measurement
- Calibration of Resistance temperature detector
- Calibration of thermistor for temperature measurement
- Calibration of thermocouple for temperature
- Load Cell Characteristics

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCER 6 hours

Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer - Piezoelectric transducer -Rotary displacement transducers -Capacitive transducer – Types, Microphone-Speakers.

- Study and calibration of LVDT for displacement measurement
- Calibration of Capacitive transducer for displacement measurement
- Measurement of sound using microphones
- Calibration of microphone
- Calibration of rotameter

UNIT IV SIGNAL CONDITIONING 6 hours

Comparators- Instrumentation amplifier -Active Filters-Sample and hold circuit-A/ D Converters-Successive approximation-ADC, Flash type ADC

- Design and testing of Digital Comparator
- Design and testing of sample and hold circuit.
- Design and testing of Active filters
- Design and testing of Voltage to frequency converter and frequency to voltage converter.
- Design and testing of Flash type Analog to Digital Converters.

UNIT V MISCELLANEOUS TRANSDUCERS 6 hours

Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Gyroscope

- Design of Piezoelectric transducers using MEMS open source software (MEMS pro, SUGAR)
    i. Pressure sensors
    ii. Accelerometers
    iii. Gyroscopes

Course Outcomes:

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

1. Apply the concepts for bridges converting a physical parameter into an electrical quantity
2. Understand the functions and characteristics different resistive transducers
3. Demonstrate the working of inductive and capacitive transducers
4. Identify various signal conditioning devices and its characteristics
5. Design Piezoelectric transducers using MEMS

Text Books:

1. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and Instrumentation”, 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Patranabis. D, “Sensors and Transducers”, Prentice Hall of India, 2003.

References:

1. Doebelin. E.A, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2000. 3. John. P, Bentley, “Principles of Measurement Systems”, III Edition, Pearson Education, 2000.
2. Murthy. D. V. S, “Transducers and Instrumentation”, Prentice Hall of India, 2001.

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

Skill Oriented Course – II
B. Tech II Year II Semester

20ECE603 MATLAB FOR ENGINEERS

L	T	P	C
1	0	2	2

Pre-requisite **20MAT101, 20EEE101**

Course Description:

This course introduces students to MATLAB programming, and demonstrate its use for scientific computations. The basis of computational techniques is expounded through various coding examples and problems. The practical ways to use MATLAB will be discussed.

Course Objectives:

This course enables students to

1. Understand basic MATLAB commands and elementary functions
2. Study and implement mathematical operations and matrices manipulation
3. Understand MATLAB functions and expressions
4. Apply flow control and files in MATLAB
5. Understand Plotting and Simulink blocks in MATLAB

UNIT I MATLAB BASICS 6 hours

Introduction, Matlab environment, Matlab as a calculator, Matlab Online, Syntax and Semantics, Help, Data Types-Matrix, string, cell and structure, Variables and Arrays, **Initializing Variables,** Multidimensional Arrays, Sub arrays, Special Values, Displaying Output Data, Data Files, Scalar and Array Operations, Hierarchy of Operations, Built-in MATLAB Functions, Debugging MATLAB Programs

- Swap the values in two variables without using temporary variable. For example, the variable ‘x’ contains the value ‘5’ and the variable ‘y’ contains the value ‘10’. The program should swap the values in the variable’s ‘x’ and ‘y’. After the execution of the program the value in the variable ‘x’ should be ‘10’ and the value in the variable ‘y’ should be ‘5’. This should be accomplished without using the temporary variable.
- Write a function which should return either maximum or minimum value of the element in an array.
- Write a code to find whether the given number is even or not.
- Write a function that should sort the elements in the array either in the ascending order or descending order.
- Write a program which should count the number of occurrences of particular element in the array.

UNIT II MATRICES AND OPERATORS 6 hours

Introduction, Colon Operator, Accessing Parts of a Matrix, Combining and Transforming Matrices, Arithmetic operations

- Write a program to find the maximum and minimum value of the elements of the matrix
- Write a program to compute the sum of diagonal elements of the given matrix
- Write a program to test whether the given matrix is symmetric or not?

- Obtain the rank of the following matrices (i) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ (ii) $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix}$ and comment on the result.
- Write a program to check whether the given matrix is invertible or not? {Hint: A matrix is invertible if is not singular. The determinant of the matrix should not be equal to zero}
- Write a program to check the given matrix is orthogonal or not?
- Use the built-in function to compute the eigen value and the eigen vector of the given matrix. From the eigen value is it possible to find whether the given matrix is (i) Positive definite (ii) Positive semidefinite.

- Create a vector 'x' that should contain elements from 1 to 10. Write a code to perform the following operation
  (i) Add a constant (say 3) to each element of 'x'.
  (ii) Make all the even indexed elements to zero.
  (iii) Make all the odd indexed elements to zero.
  (iv) Generate 'y' which should contain elements in the reverse order of 'x'.
  (v) Generate 'y' such that it should have first five elements of 'x' and the remaining elements to zero
  (vi) Add the constant to odd indexed elements of 'x'.
  (vii) Add the constant to the even indexed elements of 'x'
- Write a program to solve the linear algebraic equation
  (i) 5x-3y+2z = 10
  (ii) -3x+8y+4z = 20
  (iii) 2x+4y-9z = 9
- Write a program to determine the eigen vector and eigen values of A = [1 2 3; 4 5 6; 7 8 9]

UNIT III FUNCTIONS AND EXPRESSIONS 6 hours

Introduction, Function I/O, Formal Definition of Functions, Sub functions, Scope, Advantages of Functions, Scripts, and Problem-Solving **File Input-Output, Expressions,** write a function which returns the "median" of the array of elements.

- Write a code to print the prime numbers from one to hundred.
- Write a function which accepts the radius of the circle as input and returns the area and perimeter of the circle.
- Write a code which will compute sum of integers ranging from 1 to 100.
- Write a code to compute the "body mass index". The input to the code should be (i) Weight and (ii) Height of the person. The output of the program should be "body mass index (bmi)"
- Write a program to convert the temperature in degrees to Celsius.
- Write a program to check whether the given string (word) is palindrome or not?
- Write a program to compute the factorial of the given number.
- Find the roots of the polynomial

$f(x) = 3x^6 + 15x^5 + 10x^3 + 4x$

- An R-L-C circuit has R = 180 ohms, C = 1/280 farads, L = 20 Henries and an applied voltage E(t) = 10 sin t. Assuming that no charge is present but an initial

current of I ampere is flowing at t = 0 when the voltage is first applied, find q and $i = \frac{dq}{dt}$ at any time t. q is given by the differential equation.

$$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E(t)$$

- The function sin(x) can be written as a Taylor series by:

$\sin x = \sum_{k=0}^{\alpha} \frac{(-1)^k x^{2k+1}}{(2k+1)!}$ Write a user-defined function file that calculates sin(x) by using the Taylor series.

UNIT IV FLOW CONTROL AND FILES 6 hours

For – Loops, While – Loops, Break Statements, Logical Indexing, Pre allocation. Data Types: Introduction, Strings, Structs, Cells. Selection, If – Statements, Relational and Logical Operators, Nested If – Statements, Variables Number of Function, Arguments, Robustness, Persistent Variables. switch and case statement, while statement, break, Continue. **Files- File Input/ Output: File I/O, Excel Files, Text Files, Binary Files.**

- Without using the **max** command, find the maximum value of matrix (a) where a =[11 3 14;8 6 2;10 13 1]

- Let x=[2 6; 1 8], y=[.8 -0.3 ; -0.1 0.2], prove that y is not the inverse matrix of x
- The value of s could be calculated from the equation below:

$$s = \begin{cases} \sqrt{y^2 - 4xz} & if \ \ y \geq 4xz \\ \alpha & if \ \ y > 4xz \end{cases}$$

write a MATLAB program in M-File to do the following steps: -

a) input the value of x, y, z

b) calculate s

c) print the output as shown below

x = . . .
y = . . .
z = . . .
s = . . .

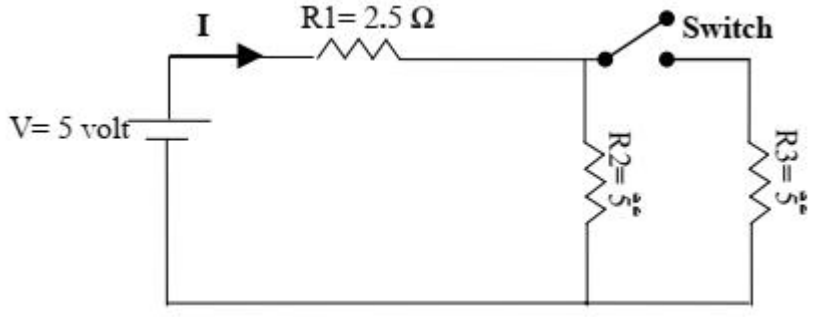
- Use a for-end loop in a script file to calculate the sum of the first n terms of the series:

$\sum_{k=1}^{n} \frac{(-1)^k k}{2^k}$ Execute the script file for n = 4 and n = 20.

- Write a program to find the current I in the circuit shown below

a) By using conditional statements.

b) Without using any conditional statements.



UNIT V PLOTTING AND SIMULINK 6 hours

Two – Dimensional Plots - Plot, fplot, Multiple Graphs, Formatting, Logarithmic Axes, Error Bars, Special Graphics, Histograms, Polar Plots, Multiple Plots on The Same Page, Multiple Figure Windows, **Three-Dimensional Plots-** Line Plots, Mesh and Surface Plots, Special Graphics, View Command. **Simulink:** Getting Started, Simulink Library Browser, Basic Elements-Blocks, Lines, building a System-Gathering Blocks, Modifying the Blocks, Connecting the Blocks, Running Simulations, Specification, Toolboxes, Building Systems.

- The expression for sine wave is given by $x(t) = A\sin(2\pi ft + \phi)$ .Write a code which accepts the input as (i) Amplitude (A) (ii) Frequency (f) and (iii) Phase(ϕ) and generates the sine wave. Plot the sine wave.
- Write a program to convert the sine wave to (i) Half wave rectified sine wave and (ii) Full wave rectified sine wave.
- Write a program which converts the sine wave to a square wave [Equivalent to that of "zero-crossing detector" or "comparator" concept in "Linear Integrated Circuits"].
- Write a program to generate three-phase sinusoidal signal. [The student should know what is the phase difference between three phases in a three-phase sinusoidal signal and the importance of three phase power]
- Design a Simulink block for power electronic circuits

Course Outcomes:

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

1. Interpret the MATLAB commands and elementary functions
2. Solve mathematical operations and matrices manipulation
3. Apply MATLAB functions and expressions
4. Execute implementation of flow controls and files in MATLAB
5. Demonstrate Plotting and Simulink blocks in MATLAB.

Text Books:

1. Getting Started with MATLAB, Rudra Pratap Oxford University Press, 1st edition, 2019

2. MATLAB for Beginners: A Gentle Approach, Kattan, Peter Issa, Petra books, 2008

Reference Books:

1. MATLAB for Engineering Applications, William Palm, Mcgraw Hill,4th edition, 2019.

2. MATLAB for Engineers**,** Holly Moore, Pearson Education,5th edition,2018

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electronics and Communication Engineering

Skill Oriented Course – III

B. Tech III Year I Semester

20ECE604 PRINTED CIRCUIT BOARD (PCB) DESIGNING

L	T	P	C
1	0	2	2

Pre-requisite 20ECE203

Course Description:

This course is intended to give students a basic understanding of PCB design. PCB design is an important aspect of every electronic product, and this course is meant to prepare students to design their own PCB projects to meet industrial standards.

Course Objectives:

This course enables students to

1. Study the fundamental steps involved in PCB design.
2. Understand the concept of designing single layer and multilayer PCB.
3. Study the different design considerations of PCB Fabrication.
4. Obtain knowledge of various EDA tools for PCB designing.
5. Study various standards in PCB testing.

UNIT I Introduction 6 hours

PCB definition, Evolution of PCBs, PCB materials, PCB design tools, PCB development process, PCB soldering tools, soldering flux, soldering wires, and cleaning materials.

- Introduction to Printed circuit board: Fundamental of electronic components.
- Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, crosstalk, check and inspection of artwork

UNIT II Fundamentals of Printed Circuit Boards 6 hours

Components of PCB, Basic Electronic Circuits, Classification of PCBs, Manufacturing of PCBs, Single sided, double sided, Multilayer, and Flexible Boards, Challenges in PCB design and Manufacturing, Standards on PCB.

- Study on types of PCB layers, through Hole and SMD Components.
- Schematic Creation and simulation of an electronic circuit
- Mapping Components of an electronic circuit
- Set Parameters for PCB Design.

UNIT III Layout Design Considerations 6 hours

General PCB design Consideration, Mechanical Design Consideration, Electrical Design Consideration, Conductor Patterns, Component Placement Rules, Fabrication and Assembly Consideration, Environmental Factors, Cooling Requirements and Package Density.

- Create PCB Layout of a clamper circuit
- Create PCB Layout of a Full-wave Rectifier.
- Create PCB Layout of an ASTABLE MUTIVIBRATOR USING 555 IC

UNIT IV Electronic Design Automation Tools 6 hours

Introduction to Electronic design automation (EDA) tools for PCB designing: Brief Introduction of various simulators, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto-routing and manual routing. Assigning specific text (silkscreen) to design, creating design report, and creating manufacturing data (GERBER) for design.

- Create PCB Layout of Transistor Amplifier.
- Create PCB Layout of RC Phase Shift Oscillator Circuit
- Create PCB Layout of Summing Amplifier Using OPAMP
- Create PCB Layout of full adder using half-adders.

UNIT V Quality, Reliability, and Acceptability Aspect 6 hours

Quality assurance, Teasing for Quality Control, Quality Control Methods, Testing of Printed Circuit Boards, Reliability Testing, Acceptability of PCBs, and Useful Standards.

- Create PCB Layout of J-K flip flop.
- Create PCB Layout of 4-BIT Binary Counter
- Create PCB Layout of variable DC power supply.
- Create PCB Layout of Temperature Sensing Circuit

Course Outcomes:

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

1. Understand the fundamental process in PCB design**.**
2. Understand the design and manufacturing techniques of PCB.
3. Create and Fabricate PCB using EDA tools.
4. Comprehend the standards involved in PCB design.
5. Evaluate and test the PCB for the designed circuits.

Text Book(s)

1. Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002

2. Simon Monk, Make your own PCBs with Eagle: from schematic designs to finished boards, McGraw-Hill Education Pvt Ltd., 2014.

Reference Books

1. RS Khandpur, Printed Circuit Board, Tata McGraw Hill Education Pvt Ltd., New Delhi,2006

2. C. Coombs, Printed Circuits Handbook, McGraw-Hill Professional, 6 editions, 2007

3. Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008

4. S D Mehta, Electronic Product Design Volume-I, S Chand Publications, 2011

5. V. Shukla, Signal Integrity for PCB Designers, Reference Designer, 2009

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Dept. of Electronics and Communication Engineering

Skill Oriented Course – III

B. Tech III Year I Semester

20ECE605 ARTIFICIAL INTELLIGENCE FOUNDATIONS

L	T	P	C
1	0	2	2

Pre-requisite Nill

Course Description:

This laboratory course will drive the students into the fundamentals of AI, basic principles of data structure and data visualization. Also develop a practical understanding of Python as an AI tool.

Course Objectives:

This course enables students to

1. Train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 6 hours

Evolution and Definition of AI, Difference Between Narrow, General and Super AI, Applications of AI across industries, Opportunities in AI, Principles of Machine Learning.

1. Study of Numpy and Pandas basic programs.
2. Write a program to implement Breadth First Search using Python.

UNIT II DATABASE CONCEPTS 6 hours

Introduction to Database Concepts, Foundations of Databases, Implementations of Database Structures

1. Write a program to implement Depth First Search using Python
2. Write a program to implement Tic-Tac-Toe game using Python.

UNIT III AI PROGRAMMING FUNDAMENTALS: PYTHON 6 hours

Introduction to AI Programming with Python, Basic Python Programming for AI, Algorithms, Sorting Algorithms, Searching Algorithms, Geometric and Graphing Algorithms.

1. Write a program to implement 8-Puzzle problem using Python.
2. Write a program to implement Water-Jug problem using Python
3. Write a program to implement Travelling Salesman Problem using Python

UNIT IV AI STATISTICS: PYTHON 6 hours

Basic Statistic Concepts, Descriptive Statistics.

1. Write a program to implement Tower of Hanoi using Python.
2. Write a program to implement Monkey Banana Problem using Python.

UNIT V DATA VISUALIZATION WITH PYTHON 6 hours

Fundamentals of Data Visualizations, Types of Visualization Tools: Basic and Specialized, Graph Types.

1. Write a program to implement Missionaries-Cannibals Problems using Python.
2. Write a program to implement 8-Queens Problem using Python

Course Outcomes:

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

1. Formulate a problem and build intelligent agents
2. Apply appropriate searching techniques to solve a real world problem
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports

Text Book(s)

1. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.

2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

Reference Books

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.

2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.

3. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electronics and Communication Engineering

Skill Oriented Course – III

B. Tech III Year I Semester

20ECE606 OBJECT ORIENTED PROGRAMMING USING C++

L	T	P	C
1	0	2	2

Pre-requisite Nill

Course Description:

This lab course provides in-depth coverage of object-oriented programming principles and techniques using C++. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features.

Course Objectives:

This course enables students to

1. Provide basic characteristics of OOP through C++.
2. Introduce the concepts of class, method, constructor, instance, overriding, overloading
3. Impart skills on various kinds of overloading and inheritance.
4. Introduce the principles of virtual functions and polymorphism
5. Introduce pointers and file handling in C++ together with exception handling mechanism

UNIT I OVERVIEW OF C++ 6 hours

Getting started with C++ syntax, data-type, variables, expressions, operators, statements, arrays, strings, pointers and functions. Introduction to object-oriented programming, user defined types, structures, unions, polymorphism, and encapsulation.

1. Create a class named 'Student' with a string variable 'name' and an integer variable 'roll_no'. Assign the value of roll_no as '2' and that of name as "John" by creating an object of the class Student.
2. Write a class having two private variables and one member function which will return the area of the rectangle.
3. Perform addition operation on complex data using class and object. The program should ask for real and imaginary part of two complex numbers, and display the real and imaginary parts of their sum.
4. Write a program that ask for two numbers, compare them and show the maximum. Declare a function called max_two that compares the numbers and returns the maximum.

UNIT II CLASSES AND DATA ABSTRACTION 6 hours

Introduction, classes, Friend functions, Friend classes, Inline functions, Constructors, Arrays of objects, This pointers, Pointers to class members, Reference parameters, Dynamic allocation operators, Function overloading, Copy constructors, Operator overloading.

1. Using function overloading write C++program to find the volume of cube, cylinder, cone and sphere.
2. Write a C++ program illustrating an interactive program for swapping integer, real, and character type variables without using function overloading. Write the same program by using function overloading features and compare the same with its C counterpart.

3. Write a C++ program to perform different arithmetic operation such as addition, subtraction, division, modulus and multiplication using inline function.

UNIT III INHERITANCE, VIRTUAL FUNCTION & POLYMORPHISM 6 hours

Concept of inheritance. Derived class and based class. Derived class constructors, Member function, Class hierarchies, public and private inheritance, aggregation: Classes within classes, inheritance and program development, static and dynamic binding, Virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

1. Write a program to swap private data members of classes named class_1, class_2 using friend function.
2. Using operator overloading write a C++ program for class STRING and overload the operator + and == to concatenate two strings length.
3. Write a C++ program illustrating Constructor overloading (Both parameterized and default).

UNIT IV FILE STREAMS 6 hours

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Error handling during file operations.

1. Write a C++ program to read and print employee details using Files.
2. Write a C++ program to copy the contents of one text file to another file.
3. Write a C++ program that uses function template to determine the square of an integer, a float and a double
4. Write a Template Based Program to Sort the Given List of Element

UNIT V GENERIC PROGRAMMING AND EXCEPTIONS 6 hours

Function templates, Overloading template functions, Class templates, Exception handling techniques.

1. Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly.
2. Write a Program to Demonstrate the Catching of All Exceptions

Course Outcomes:

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

1. Understand the features of C++ supporting object-oriented programming
2. Apply the concepts of class, method, constructor, instance, overriding, overloading
3. Choose suitable inheritance while proposing solution for the given problem.
4. Apply virtual and pure virtual function & complex programming situations
5. Implement Object Oriented Programs using templates and file handling concepts.

Text Book(s)

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill

Reference Books

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education

2. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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Skill Oriented Course – IV

B. Tech III Year II Semester

20ECE607 REAL TIME OPERATING SYSTEMS (RTOS)

L	T	P	C
1	0	2	2

Pre-requisite 20ECE107

Course Description:

This laboratory course emphasizes to the students to understand the concepts of real time operating systems (RTOS). This course covers the different types of policies, multi-resource services and give embedded system components. It also covers the High availability and Reliability Design.

Course Objectives:

This course enables students to

1. Understand the introduction of real-time embedded systems
2. Know the different types of policies.
3. Understand the Multi-Resource Services techniques.
4. Learn the Embedded System Components.
5. Know the embedded system design based on availability and reliability.

UNIT I INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS 6 hours

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility. Uniprocessor Scheduling: Types of scheduling algorithms: FCFS, SJF, Priority, Round Robin UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept.

- Write the pseudo code in Linux using C/C++ to perform FCFS scheduling
- Write the pseudo code in Linux using C/C++ to perform Round Robin scheduling

UNIT II RTOS POLICIES AND PROCESS MANAGEMENT 6 hours

Pre-emptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies. I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency.

PROCESS MANAGEMENT: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

- Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing.
- Write an application that Demonstrates the interruptible ISRs (Requires timer to have higher priority than external interrupt button

UNIT III MULTI-RESOURCE SERVICES& INTER-PROCESS COMMUNICATION 6 hours

Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, mixed hard and soft real-time services. Messages, Buffers, mailboxes, queues, semaphores

- Study of Semaphore & Write appropriate the pseudo code in Linux using C/C++
- Write an application to Test message queues and memory blocks

UNIT IV EXCEPTIONS, INTERRUPTS AND TIMERS 6 hours

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

- Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
- Write an application that creates a two task to Blinking two different LEDs at different timings.

UNIT V CASE STUDIES 6 hours

Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

- Developing image processing application with Linux OS on Xilinx FPGA
- Porting Linux and developing simple application on Xilinx Zed board

Course Outcomes:

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

1. Introduce real-time embedded systems
2. Describe the different types of policies.
3. Demonstrate the Multi-Resource Services techniques.
4. Explain the Embedded System Components.
5. Explain the embedded system design based on availability and reliability.

Text Book(s)

1. C.M. Krishna and G.Shin, Real Time Systems, McGraw-Hill International Edition, 2017.

2. Jean J Labrosse, Embedded Systems Building Blocks Complete and Ready-to-use Modules in C, CMP books, 2/e, 1999. (reprint 2011)

Reference Books

1. Jean J Labrosse, Micro C/OS-II, The Real Time Kernel, CMP Books, 2011.

2. Sam Siewert, V, Real-Time Embedded Components and Systems: With Linux and RTOS (Engineering), 2015.

3. Rajkamal, “Embedded Systems- Architecture, Programming, and Design”, 2007, TMH.

4. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

5. David E. Simon, An Embedded Software Primer, Volume1.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of Electronics and Communication Engineering

Skill Oriented Course – IV

B. Tech III Year II Semester

20ECE608 INTERNET OF THINGS

L	T	P	C
1	0	2	2

Pre-requisite 20ECE404

Course Description:

This laboratory course is a network of a wide variety of thing such as moisture, temperature, motion detection and many more. The thing can be measured with the sensors and process through microcontroller devices. These devices also use the data processing units and gateways to process the data to control the other ends. This course is an introduction to the embedded devices, communication protocols and APIs used in IoT.

Course Objectives:

This course enables students to

1. Introduce the basic understanding IoT system
2. Expose the student to a variety of embedded system and interfaces
3. Create a basic understanding of the communication protocols in IoT communications.
4. Familiarize the student with networking and application program interfaces for IoT.
5. Enable students to create various use cases of IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS (IoT) 6 hours

Introduction, Concept and History: IOT History, IoT Applications, Requirements of IoT, Understanding IoT fundamentals, IOT Architecture and IOT challenges. Major functional components of IoT, IoT enabling technologies IoT, Standards IoT Entities, Overview of Sensors, Categorization of sensors and their working, Actuators, Gateways, Cloud and Web of technology.

Lab practices: -

1. Study on IoT Platform a) Getting information and study of IOT microcontrollers (Arduino, Raspberry-pi)
2. Study on IoT Platform a) Getting information about Sensors (IR, temperature, pressure, gas sensor) b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

UNIT II EMBEDDED SYSTEM (ARDUINO AND RASPBERRY PI) AND PERIPHERAL INTERFACES 6 hours

Embedded Computing Basics; Microcontrollers; System-on-Chips. ARM Architecture, Arduino Board development platform and Raspberry PI development platform.

IoT with Arduino General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces: I2C, SPI Sensors interfacing with Raspberry PI , IoT Real Time Operating Systems, General Purpose I/O(GPIO) Serial Communication Interfaces: RS-232/485 Synchronous Peripheral Interfaces, I2C,SPI Sensors Interfacing with Raspberry Pi, Introduction of Arduino Python programming for IOT.

Lab practices: -

1.Programming with Arduino platform a) Installation of Arduino in computer and verifying any errors in connection. b) Control LED using Arduino c) Traffic Light Control

2.Programming with Arduino platform and Reading from Sensors a) interfacing sensors to Arduino board and getting information from them (any two sensors). b) Experiment with both analog and digital sensors.
3.Programming with Resperrypi a) Displaying Date on Serial Monitor b) Automated Door Opening System

UNIT III COMMUNICATION PROTOCOL FOR IOT 6 hours

Wireless Sensor Networks & Protocols, Machine to Machine Communication, Wired Communication Protocols. Ethernet Serial Communications, Wireless Communication protocols: Wifi, RF, IPV4/V6, 6LOWPAN, ZigBee (IEEE802.15.4) BLE, GSM(2G/3G/LTE),NFC, RF Comm and z wave and MAC Addresses, Application of MQTT/MQTT-SN, HTTP REST, XMPP and AMQP.

Lab practices
1.Connecting Android Phone with Arduino:
a) Connecting Arduino with Mobile Device Using the Bluetooth Module.
b) Control any two actuators connected to the development board using
2. Integrating Ethernet Shield. Read data from sensor and send it to a requesting client using socket communication. Note: The client and server should be connected to same local area network.
3. Creating Mobile App a) Create a mobile app to control an actuator. b) Control Electronic Devices from anywhere across the world using Internet & Mobile App.

UNIT IV NETWORKING FOR IOT 6 hours

Network Layer Model (OSI or TCP/IP), Network Topologies, Clouding computing, fog computing and big data technology, data handling and analytics, Introduction of Software define networking, Introduction of API and how to define new API.
Lab practices

1. Interfacing Cloud a) Push sensor data to cloud - Use Arduino to Upload data from Environmental Sensors to Cloud Server. b) Control an actuator through cloud
2. Data analysis and Visualization Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

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

UNIT V USE CASES OF IOT 6 hours

Case study of IOT applications
Introduction, models, technology used: Industrial internet of things, connected vehicles, Agriculture and IOT. Heath care and IOT, Smart grid system, Smart cities IoT Wearables, Health care systems and Allied sectors.
Lab practices
1. Mini Project Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it.

Course Outcomes:

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

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application with cloud and TCP/IP Model.

Text Book(s)

1. Hanes, David, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry. IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press, 2017.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.

Reference Books

1. NPTEL Course on: Introduction of Internet of Things. By Prof. Sudip Misra | IIT Kharagpur
2. Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling technologies, platforms, and use cases. Auerbach Publications, 2017.
3. Richardson, Matt, and Shawn Wallace. Getting started with raspberry PI. " O'Reilly Media, Inc.", 2012.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor in Electronics & Communication Engineering
Stream Name: Communication Systems (CS)

Minor

20MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course explores semiconductor physics, and operation & applications of semiconductor devices such as p-n junctions, BJTs, and MOSFETs. It also covers operational amplifiers and applications of operational amplifiers.

Course Objectives:

This course enables students to

1. Understand the operation of the basic semiconductor diodes, i.e., the p-n junction diode and Zener diodes.
2. Understand the operation of BJTs, JFETs and MOSFETs.
3. Know the applications of p-n junctions, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Know the applications of operation differential amplifier.

UNIT I P-N JUNCTION DIODE 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown of p-n junctions. Operation and I-V characteristics of Zener diodes. Tunnel diodes, Varactor diodes, Metal-semiconductor junctions.

UNIT II TRANSISTORS 9 hours

BJTs: Structure, operation, and I-V characteristics of BJTs. Early effect in BJTs.
JFET: Structure, operation, and I-V characteristics of JFETs.
MOSFET: Structure, operation, and I-V characteristics of MOSFETs. Channel length modulation in MOSFETs.

UNIT III APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown junctions: Half wave, full wave and bridge rectifiers. Clipping and clamping circuits. Voltage regulator circuit using Zener diodes.
BJTs: BJT as an amplifier and a switch. Biasing in BJT amplifier circuits.
MOSFETs: MOSFET as an amplifier and a switch. Biasing in MOSFET amplifier circuits.

UNIT IV OPERATIONAL AMPLIFIERS 9 hours

Principle of operation differential amplifier, calculation of differential gain, common mode gain and CMRR – DC and AC characteristics, Inverting – Non-inverting amplifier – Summing and difference amplifiers, Integrators and Differentiators circuits.

UNIT V APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

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

Course Outcomes:

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

1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. D. Neamen and D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

2. B.G. Streetman and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson, 2016.

Reference Books

1. S. M. Sze and K. K. Ng, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2007.
2. A. S. Sedra and K. C. Smith, “Microelectronic Circuits: Theory and Applications”, 6th edition, Oxford Press, 2013.
3. J. Millman and A. Grabel, “Microelectronics”, 2nd edition, McGraw-Hill.

4. Paul Scherz and Simon monk “Practical electronics for inventors” 4th edition, McGraw-Hill Education, 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE102 COMPUTER COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course describes develop an understanding of modern network architectures from a design and performance perspective. The course also introduces concepts of working of the internet by introducing layered architectures of OSI and TCP/IP.

Course Objectives:

This course enables students to

1. To develop an understanding of modern network architectures.
2. To acquire knowledge and understanding on data flow, error control, MAC layer.
3. To understand the basics of masking in Network layer required for CCN.
4. To acquire the knowledge involved protocols related to Transport Layer.
5. To understand the requirement of distinct client-server model, DNS, FTP, HTTP, cryptography etc to be applicable in large CCN.

UNIT I DATA COMMUNICATION COMPONENTS 9 hours

Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT II DATA LINK LAYER AND MEDIUM ACCESS LAYER 9 hours

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT III NETWORK LAYER 9 hours

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT IV TRANSPORT LAYER 9 hours

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT V APPLICATION LAYER 9 hours

Client Server Model, Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Cryptography.

Course Outcomes:

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

1. Interpret the design principles that govern connected devices and select a platform for a particular embedded computing application
2. Develop simple applications using Arduino microcontroller
3. Develop simple applications using Raspberry Pi
4. Utilize the Internet communication protocols for IoT applications
5. Design and develop a solution for a given application with cloud and TCP/IP Model.

Text Book(s)

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.

2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference Books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.

3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE103 ANALOG AND DIGITAL COMMUNICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course is to provide a basic introduction to analog digital communications. Topics include understanding of analog continuous wave modulation and evaluate the performance of these systems in the presence of noise; study of various analog and digital pulse modulation schemes; principle of digital baseband and pass band communication systems, channel coding and equalization techniques to improve the system performance.

Course Objectives:

This course enables students to

1. To study the fundamental concepts of communication theory.
2. To analyze various analog continuous wave modulation and pulse modulation techniques.
3. To evaluate the performance of analog communication systems in the presence of noise.
4. To study different baseband and bandpass digital modulation techniques.
5. To study the performance of digital receivers.

UNIT I NOISES ANALYSIS 9 hours

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

UNIT II ANALOG MODULATION 9 hours

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Frequency Division Multiplexing. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT III DIGITAL KEYING TECHNIQUES 9 hours

Pulse modulation, Sampling process. PAM, PPM, PWM and Pulse code modulation (PCM), Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers. Differential pulse code modulation and Adaptive PCM. Delta modulation.

UNIT IV SHIFT KEYING TECHNIQUES 9 hours

Baseband Pulse Transmission- Matched Filter – Error rate- Inter-Symbol Interference and Nyquist criterion. Pass band Digital Modulation Schemes-Passband Transmission Model- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Minimum Shift Keying.

UNIT V SIGNALS CONDITIONING 9 hours

Linear Block Codes- Convolutional codes- Linear equalization and Decision Feedback techniques for band-limited channels- Adaptive Equalization- Synchronization and Carrier Recovery for Digital modulation.

Course Outcomes:

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

1. Analyze the analog continuous wave modulation techniques in time and frequency domain.
2. Evaluate the performance of continuous wave modulation systems in the presence of noise.
3. Study of various analog and digital pulsed modulation techniques.
4. Understand of various digital baseband and bandpass modulation techniques.
5. Study of improvement in the performance of digital communication system using channel coding and equalization technique.

Text Book(s)

1. Simon Haykin and Michale Moher, "An Introduction to Analog and Digital Communications", 2nd Edition, John Wiley and Sons, 2007.
2. B. P. Lathi and Zhi Ding, "Modern Analog and Digital Communication Systems", 4th Edition, Oxford University Press, 2010.
3. Simon Haykin and Michale Moher, "Communication Systems", 4th Edition, John Wiley and Sons, 2004.

Reference Books

1. H. P. Hsu, "Theory and Problems of Analog and Digital Communications", 3rd Edition, Schaum's Outline, 2009.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering", John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2000

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE104 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course gives an introduction to Satellite Communication Systems which combines diverse topics like radio-wave propagation, antennas, modulation, demodulation, coding, orbital mechanics etc. The spacecraft link analysis and link design will be dealt in detail. The various satellite access techniques like FDMA, TDMA and CDMA will be analyzed from bandwidth utilization and throughput capability. The Indian National Satellite System (INSAT) will be covered in detail giving its specifications, features and services provided. The INTELSAT and other programs will also be covered. The VSAT, Mobile satellite communication and Personal Satellite communication will be discussed. The principles of Global Positioning System (GPS) principles, GPS receivers and its applications would be covered. The regulatory and interference issues will also be covered.

Course Objectives:

This course enables students to

1. To make the students understand the basic concept in the field of Satellite Communication and to know how to place a satellite in an orbit.
2. To calculate the link power budget.
3. To get a complete knowledge about the earth and space subsystems
4. To gain knowledge about the Satellite Access schemes
5. To gain knowledge about the Satellite system and mobile services provided

UNIT I INTRODUCTION AND SATELLITE SUBSYSTEMS 9 hours

Historical background, Overview of satellite communications, Orbital Mechanics, Useful orbits for satellite communications, look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance. Satellite Subsystems: Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification.

UNIT II MODULATION, MULTIPLEXING, MULTIPLE ACCESS TECHNIQUES AND TRANSMISSION THEORY 9 hours

Frequency Modulation (FM), Analog FM transmission by satellite, Digital Transmission, Digital Modulation and Demodulation, Bit and symbol error rates BPSK, QPSK, Digital transmission of analog signals, Time division Multiplexing (TDM), Frequency division multiple access (FDMA) Time Division multiple access (TDMA) frame structure, examples. Satellite switched TDMA onboard processing, DAMA, code division multiple access (CDMA), spread spectrum transmission and reception. Basic transmission theory, EIRP, system noise temperature and G/T ratio, design of down links, uplink design.

UNIT III EARTH STATIONS AND RADIO WAVE PROPAGATION EFFECTS 9 hours

Earth Stations: Introduction, transmitters, receivers, Antenna and feed systems, tracking systems, network interface subsystem, monitoring and auxillary equipment. Radio wave propagation effects & Impact on Satellite Links: Quantifying attenuation and depolarization, Atmospheric absorption, Cloud attenuation, Rain and ice effects, Prediction of rain attenuation, prediction of XPD, Propagation of Impairment countermeasures.

UNIT IV COMMERCIAL SATELLITE SYSTEMS AND VAST SYSTEMS 9 hours

INSAT, INTELSAT and EUTELSAT programmes: Services and salient features VSAT Systems: Overview, Network Architecture, access control protocols, basic techniques, VSAT earth station engineering, calculation of Link margins for VSAT star network, System design procedure example, new developments.

UNIT V **MOBILE SATELLITE COMMUNICATIONS, NON-GEOSTATIONARY SATELLITE ORBIT (NGSO) SYSTEMS AND GPS** **9 hours**

Mobile Satellite Communications and Non-Geostationary Satellite Orbit (NGSO) Systems: The third generation satellite communication, the need for mobile and personal communication, NGSO considerations, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs. Satellite Navigation and The Global Positioning System (GPS):Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, differential GPS.

Course Outcomes:

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

1. Explain the principles, concepts and operation of satellite communication systems.
2. Describe the concepts of signal propagation affects, link design, rain fading and link availability and perform interference calculations.
3. Understand modulation techniques and error correction codes for satellite communication.
4. Use software tools to simulate and analyze the performance of satellite communication systems and use real satellite up/down links (subject to the availability of satellite links) to conduct link experiments.
5. Critically analyze the design requirements and the performance of satellite communication systems, including the GPS systems.

Text Book(s)

1. T. Pratt, C. W. Bostian and J. E. Allnutt, “Satellite Communications,” Wiley India, 2nd ed., 2006.

2. Dennis Roddy, “Satellite” Forth edition, Tata McGraw-Hill, Special Indian edition, 2009.

Reference Books

1. Global Navigation satellite systems - B. S. Rao (TMH).

2. G. Maral and M. Bousquet, “Satellite Communications Systems—Systems, Techniques and Technology” John Wiley & Sons, 5thedition, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE105 OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course provides details about light propagation in fibers, attenuation and dispersion in fibers, generation of light chirp and hopping signals, design of optical receiver, design of fiber amplifier and design of time division and wave length division systems.

Course Objectives:

This course enables students to

1. Enumerate the theoretical aspects of light transmission in optical fiber.
2. Understand optical sources, detectors and amplifiers.
3. Understand TDM and WDM systems.
4. Study the characteristics of optical fiber, sources and detectors.
5. Estimate optical link budget consisting of optical sources, fibers and detectors.

UNIT I OPTICAL FIBERS 9 hours

Ray Theory transmission. Optical Confinement, cutoff condition, single mode/multimode concept. Losses and Dispersion in optical fibers: Attenuation, Material Absorption Losses in Silica Glass Fibers, Linear Scattering Losses, Fiber Bend Loss, Non Linear effects in optical fibers-SRS, SPM, SBS, FWM Dispersion, Chromatic dispersion, Intermodal dispersion, Overall fiber dispersion, Polarization. Chirped Gaussian pulses, Broadening of chirped Gaussian pulses, controlling the dispersion profile.

UNIT II OPTICAL SOURCES 9 hours

Light Emitting Diodes (LEDs): LED Structures, Light Source Materials, Quantum efficiency and LED Power, Modulation of LED. LASER Diodes- Laser Diode Modes, laser action, mode selection and Threshold Conditions, Some Injection laser structures-Gain guided lasers, index guided lasers, quantum well lasers, quantum dot lasers, Single frequency injection lasers-Short and coupled cavity lasers, distributed feedback lasers, vertical cavity surface emitting lasers, Injection laser characteristics, Threshold current dependence, Dynamic response, Frequency Chirp, noise, mode hopping, Reliability.

UNIT III PHOTO DETECTORS 9 hours

Physical principles of photo diodes, photo detector noise, detector response time, avalanche multiplication noise, structures for InGaAs APDs, temperature effect on avalanche gain, Receiver design, S/N estimation, Digital optical receivers, Digital receiver sensitivity, comparisons of photo detectors. Design issues, S/N and BER optimization, Practical receiver.

UNIT IV OPTICAL AMPLIFIERS 9 hours

Optical amplifiers-Semi-conductor optical amplifiers-performance characteristics, gain clamping, quantum dots, Fiber and waveguide amplifiers- Rare earth fiber amplifiers, Raman and Brillouin amplifiers, Wave guide amplifiers and fiber amplifiers, optical parametric amplifiers, wideband fiber amplifiers, Semi-conductor laser amplifiers- SLA, Design and applications of amplifiers.

UNIT V MULTIPLEXING CONCEPTS AND OPTICAL SYSTEMS 9 hours

WDM Concepts and components: Over-view, Passive optical couplers, Isolators & circulators, Fiber grating filters, dielectric thin film filters, and Phased array based devices, Diffraction gratings, Active optical components, tunable light sources. Time Division Multiplexing- Optical TDM techniques, Soliton communication- Solition generation, solution interaction, High capacity solution systems and jitter eduction, WDM solution system- Solition Multiplexing techniques, new trends in optical communication. Optical Systems: Point to point links, power penalties, and error control. Power penalty considerations and link budget analysis. Different topologies used in optical networks, optical LAN, WANS, SONET/SDH, WDM light wave system- Channel spacing decision, multipliers, design issues.

Course Outcomes:

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

1. Understand the structures of Optical fibers and its types.
2. Estimate attenuation and dispersion in optical fiber.
3. Describe various optical sources and detectors for communication applications.
4. Analyze the characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusion.
5. Evaluate optical link budget consisting of optical sources, fibers and detectors.

Text Book(s)

1. Govind P Agrawal, Fiber -optic Communication systems, Willey Publication 4th Edition, 2010.
2. Gerdkeiser, Optical fiber communications, McGraw Hill International Edition, 5th Edition, 2013.
3. John M. Senior, Optical fiber communications, PHI, 4rd Edition, 2010.

Reference Books

1. Max Ming-Kang Liu, Principles and Applications of Optical Communications, TMH, 2010.
2. S. C. Gupta, Text book on optical fiber communication and its applications PHI, 3rd Edition 2005.
3. Satish Kumar, Fundamentals of Optical Fiber communications, PHI, 2nd Edition, 2014.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE201 ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite **None**

Course Objectives:

This course enables students to

1. To learn the basics of communication systems.
2. Have hands on the various analog and digital modulation systems.

LIST OF EXPERIMENTS

1. Amplitude Modulation and demodulation.

2. DSB-SC modulation and demodulation.

3. SSB-SC modulation and demodulation.

4. Frequency Modulation and demodulation.

5. Pre-emphasis and De-emphasis.

6. Phase modulation and demodulation.

7. Study and simulation of signals in the presence of noise.

8. Sampling and Reconstruction.

9. Pulse Amplitude Modulation and Time Division Multiplexing.

10. Pulse Code Modulation & demodulation and Differential PCM modulation & demodulation.

11. Quadrature Phase Shift Keying and Quadrature Amplitude Modulation.

12. Line Coding, Performance of Unipolar and Bipolar systems.

13. FSK, PSK and DPSK schemes.

Course Outcomes:

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

1. Understand the fundamental concepts of communication systems.
2. To analyse various analog and pulse modulation schemes.
3. To study the performance of communication systems in the presence of noise.
4. To analyse different digital modulation schemes & identify their application.
5. Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor in Electronics & Communication Engineering
Stream Name: Embedded Systems (ES)

Minor

20MDECE101 ELECTRONICS ENGINEERING: BASIC PRINCIPLES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course explores semiconductor physics, and operation & applications of semiconductor devices such as p-n junctions, BJTs, and MOSFETs. It also covers operational amplifiers and applications of operational amplifiers.

Course Objectives:

This course enables students to

1. Understand the operation of the basic semiconductor diodes, i.e., the p-n junction diode and Zener diodes.
2. Understand the operation of BJTs, JFETs and MOSFETs.
3. Know the applications of p-n junctions, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Know the applications of operation differential amplifier.

UNIT I P-N JUNCTION DIODE 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown of p-n junctions. Operation and I-V characteristics of Zener diodes. Tunnel diodes, Varactor diodes, Metal-semiconductor junctions.

UNIT II TRANSISTORS 9 hours

BJTs: Structure, operation, and I-V characteristics of BJTs. Early effect in BJTs.
JFET: Structure, operation, and I-V characteristics of JFETs.
MOSFET: Structure, operation, and I-V characteristics of MOSFETs. Channel length modulation in MOSFETs.

UNIT III APPLICATIONS OF DIODES AND TRANSISTORS 9 hours

P-N junction: Formation, operation, I-V characteristics, small signal switching models, and avalanche breakdown junctions: Half wave, full wave and bridge rectifiers. Clipping and clamping circuits. Voltage regulator circuit using Zener diodes.
BJTs: BJT as an amplifier and a switch. Biasing in BJT amplifier circuits.
MOSFETs: MOSFET as an amplifier and a switch. Biasing in MOSFET amplifier circuits.

UNIT IV OPERATIONAL AMPLIFIERS 9 hours

Principle of operation differential amplifier, calculation of differential gain, common mode gain and CMRR – DC and AC characteristics, Inverting – Non-inverting amplifier – Summing and difference amplifiers, Integrators and Differentiators circuits.

UNIT V APPLICATIONS OF OPERATIONAL AMPLIFIER 9 hours

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

Course Outcomes:

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

1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. D. Neamen and D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

2. B.G. Streetman and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson, 2016.

Reference Books

1. S. M. Sze and K. K. Ng, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2007.
2. A. S. Sedra and K. C. Smith, “Microelectronic Circuits: Theory and Applications”, 6th edition, Oxford Press, 2013.
3. J. Millman and A. Grabel, “Microelectronics”, 2nd edition, McGraw-Hill.

4. Paul Scherz and Simon monk “Practical electronics for inventors” 4th edition, McGraw-Hill Education, 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE108 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course provides computer architecture, instruction set design, memory organization, ALU operations, I/O interfaces and multi computing systems.

Course Objectives:

This course enables students to

1. To provide an introduction to concepts in computer architecture.
2. Impart knowledge on design aspects, system resources such as memory technology and I/O subsystems needed to achieve increase in performance.
3. Acquaint the students with current trends in computing architecture.

UNIT I INTRODUCTION TO COMPUTERS **9 hours**

Introduction to computer abstractions and technology, CPU performance, the power wall, Switch from uniprocessors to multiprocessors.

UNIT II INSTRUCTIONS **9 hours**

instructions, Logical operations, Instructions for making decisions, Supporting procedures in computer hardware, Communicating with people, MIPS architecture and instruction set.

UNIT III PIPELINE ARCHITECTURES **9 hours**

Logic design conventions, data path design, a simple implementation scheme, Control hardware, Pipelining overview, Pipelined data-path and control.

UNIT IV ARITHMETIC OPERATIONS **9 hours**

Addition, Subtraction, Multiplication, Division, Floating point arithmetic, Parallelism and Computer Arithmetic, Floating point in the x86, Forwarding versus stalling, Control hazards, Exceptions, Branch prediction.

UNIT V MEMORY ORGANIZATIONS & MULTI-PROCESSORS **9 hours**

Introduction to memory organization, Basics of caches, cache performance, Virtual memory, Introduction to Storage, Dependability reliability and Availability, Disk storage, Flash storage, Connecting processors memory and I/O devices, Interfacing I/O devices, Introduction to multicores ,multi-processors and clusters, Creating parallel processing programs, Shared memory multiprocessors, Clusters and other message passing multiprocessors, Hardware multi-threading, SISD, MIMD,SIMD,SPMD, Vector.

Course Outcomes:

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

1. Acquire basic knowledge on the operation of semiconductor devices like p-n junctions, Zener diodes.
2. Compare the operation of BJTs, JFETs and MOSFETs
3. Design various circuits using p-n junctions, Zener diodes, BJTs and MOSFETs.
4. Understand the Principle of operation differential amplifier.
5. Obtain the applications of operation differential amplifier.

Text Book(s)

1. Patterson, D.A. & J.L. Hennessy, Computer Organization and Design, Elsevier, 4th ed.,2009.

2. William Stallings, Computer Organisation & Architecture, Pearson, 8th ed., 2010.

Reference Books

1. Patterson, D.A. & J.L. Hennessy Computer Architecture: A Quantitative Approach,5th Edition, 2012.

2. Hamacher et. al, Computer Organisation, McGraw Hill, 5th ed., 2002.

3. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson.

4. M.Moris Mano ,Computer Systems Architecture , 3rd Edition,Pearson/PHI.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE109 ADVANCED MICROPROCESSORS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course facilitates the students to familiar with Advanced Microprocessors and its applications. Course covers the Introduction to the Intel 80186/80188, Programming the 80186/8018, Introduction to the 80286, 80386 & 80486. The course also includes the advanced Pentium processors introductions and Pentium Pro introductions.

Course Objectives:

This course enables students to

1. 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 9 hours

The 8086 Microprocessor: Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming.

UNIT II INTRODUCTION TO THE INTEL 80186/80188 9 hours

80186/80188 Architecture, Versions of the 80186/80188, 80186 Basic Block Diagram, 80186/80188 Basic Features, 80186/80188 Timing diagram.

UNIT III PROGRAMMING THE 80186/80188 9 hours

Enhancements, Peripheral Control Block, Interrupts in the 80186/80188, DMA Controller, Chip Selection Unit.

UNIT IV INTRODUCTION TO THE 80286, 80386 & 80486 9 hours

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.

UNIT V INTRODUCTION TO THE PENTIUM MICROPROCESSOR 9 hours

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.

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 Book(s)

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: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE110 MICROCONTROLLER PROGRAMMING WITH TI- MSP 430

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course introduces the concept of embedded system and gives introduction to the students about the Texas Instruments MSP430 architecture, interfacing techniques, peripheral details and communication model of the Texas Instruments MSP430.

Course Objectives:

This course enables students to

1. Understand the basic of MSP430.
2. Study the Architecture of the MSP430 Processor, different instruction sets.
3. Know the port programming and interfacing techniques.
4. Understand the timer and counter of MSP 430.
5. Study the different communication buses used.

UNIT I THE TEXAS INSTRUMENTS MSP430 **9 hours**

What (and Where) Are Embedded Systems? Approaches to Embedded Systems, Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Memory, Software, Where Does the MSP430 Fit? The Outside View—Pin-Out, The Inside View—Functional Block Diagram, Memory, Central Processing Unit, Memory-Mapped Input and Output Clock Generator, Exceptions: Interrupts and Resets, Where to Find Further Information.

UNIT II ARCHITECTURE OF THE MSP430 PROCESSOR **9 hours**

Central Processing Unit, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Examples Reflections on the CPU and Instruction Set, Resets, Clock System, Functions, Interrupts, and Low-Power Modes, Functions and Subroutines, Storage for Local Variables, Passing Parameters to a Subroutine and Returning a Result, Mixing C and Assembly Language, Interrupts- Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation.

UNIT III PORT PROGRAMMING **9 hours**

Digital Input and Output: Parallel Ports, Digital Inputs, Switch De-bounce, Digital Outputs, Interface between 3V and 5V Systems, Driving Heavier Loads, Liquid Crystal Displays, Driving an LCD from an MSP430x4xx, Simple Applications of the LCD.

UNIT IV WATCHDOG TIMER **9 hours**

Basic Timer1, Timer-A, Measurement in the Capture Mode, Output in the Continuous Mode, Output in the Up Mode: Edge-Aligned Pulse-Width Modulation, Output in the Up/Down Mode: Centered Pulse-Width Modulation, Operation of Timer-A in the Sampling Mode.

UNIT V COMMUNICATIONS WITH MSP-430 **9 hours**

Analog-to-Digital Conversion: General Issues, Analog-to-Digital Conversion: Successive Approximation, the ADC10 Successive-Approximation ADC9.5 Basic Operation of the ADC10, Digital-to-Analog Conversion, Serial Peripheral Interface, SPI with the USI, SPI with the USCI, A Simple I²C Master with the USCI_B0 on a FG4618.

Course Outcomes:

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

1. Demonstrate the basic of MSP430.
2. Explain the components of MSP430 Processor architecture and different instruction sets.
3. Design the port programming and interfacing techniques.
4. Design the timer and counter for various modulation schemes of MSP 430.
5. Explain the different communication buses used in MSP430.

Text Book(s)

1. Introduction to Embedded Systems- K V Shibu , McGraw Hill-2007.

2. MSP430 Microcontroller Basics - John Davies, Elsevier, 2008.

Reference Books

1. Embedded Systems Design Using the TI MSP430 Series, 1st Edition - Chris Nagy, Elsevier, 2003.
2. Analog and Digital Circuits for Electronic Control System Applications-Using the TI

3. MSP430 Microcontroller- Jerry Luecke, Elsevier, 2004.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE111 ARM – SYSTEM ON CHIP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course gives introduction to the students to understand the 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 9 hours

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.

UNIT II ARM ASSEMBLY LANGUAGE PROGRAMMING 9 hours

Data processing instructions, Data transfer instructions, Control flow instructions, 3-Stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.

UNIT III ARM INSTRUCTION SETS 9 hours

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.

UNIT IV THUMB INSTRUCTION SETS 9 hours

Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, The Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, Thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb breakpoint instruction.

UNIT V ARM PROCESSOR CORES 9 hours

ARM7TDMI, ARM8 256, ARM9TDMI 260, ARM10TDMI 263.

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 Book(s)

1. Michael J. Flynn and Wayne Luk, "Computer System Design System-on-Chip", Wiley India Pvt. Ltd.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.

Reference Books

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)", Newnes, BK and CDROM.
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

20MDECE202 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite **None**

Course Objectives:

This course enables students to

1. To understand the different types of instruction sets, addressing modes of 8086
2. To study the architecture of MSP-430.

LIST OF EXPERIMENTS

Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs

Part B: Embedded C Experiments using MSP430 Microcontroller

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430

Course Outcomes:

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

1. Program the MSP430 for various applications
2. Design a embedded system for particular application using MSP430

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors in Electronics & Communication Engineering

Honors

20HDECE101 NEURAL NETWORK AND FUZZY LOGIC

L	T	P	C
3	0	0	3

Pre-requisite **None**

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 9 hours

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.

UNIT II SINGLE LAYER FEED FORWARD NEURAL NETWORKS 9 hours

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

UNIT III MULTILAYER FEED FORWARD NEURAL NETWORKS 9 hours

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT IV INTRODUCTION TO FUZZY LOGIC 9 hours

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.

UNIT V FUZZY LOGIC APPLICATIONS 9 hours

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.

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 Book(s)

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: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE102 TESTING OF DIGITAL VLSI CIRCUITS

L	T	P	C
3	0	0	3

Pre-requisite **20ECE102, 20ECE111**

Course Description:

Testing is one of the most expensive process in the design flow of a typical chip. There exists various errors e.g. design errors, fabrication defects, fabrication errors and physical failures. This course covers: Introduction to Testing, Test methods and Design for Testability

Course Objectives:

This course enables students to

1. To know the different types of faults and to study fault detection
2. To understand the concepts of test generation - DFT and BIST.
3. To study in detail about fault diagnosis, memory testing and PLA testing

UNIT I TESTING AND FAULT MODELING 9 hours

Introduction to testing - Faults in Digital circuits - Modeling of faults - Logical fault models - Fault detection - Fault location - Fault equivalence - Fault dominance, Logic simulation - Types of Simulation - Compiled code simulation - Gate level event driven simulation - Delay models

UNIT II TEST GENERATION 9 hours

Test generation for combinational circuits - Truth table and fault matrix method – Path sensitization algorithm - Boolean difference method - D – algorithm - PODEM algorithm - FAN algorithm , Testable combinational logic circuit design, Test generation for sequential circuits - Time frame expansion - Test generation based on circuit structure and state table.

UNIT III LOGIC BUILT-IN-SELF-TEST 9 hours

Test pattern generators - Exhaustive testing - Pseudo random testing - Pseudo exhaustive testing, Output response compression techniques - ones count - transition count – parity check - syndrome check - signature analysis, BIST architectures - Built-in-Evaluation and Self Test (BEST) - Self Testing Using MISR and Parallel SRSG (STUMPS) - Built In Logic Block Observer (BILBO) - Modified BILBO

UNIT IV DESIGN FOR TESTABILITY AND MEMORY TESTING 9 hours

Testability - Controllability and Observability, Adhoc Design for testability techniques, Generic Scan based designs - Full serial integrated scan - Isolated serial scan - Non- serial scan, Boundary scan architecture. Testing of RAM - RAM functional fault models - Test algorithms - Test generation for Embedded RAM

UNIT V FAULT DIAGNOSIS AND PLA TESTING 9 hours

Diagnosis by UUT reduction, Combinational logic diagnosis - Cause-Effect analysis - Effect-Cause analysis, Self-checking design, PLA Testing

Course Outcomes:

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

1. Demonstrate different types of fault models and fault simulation.
2. Acquire complete knowledge regarding test generation for combinational circuits and sequential circuits.
3. Demonstrate the concepts of BIST and their architectures.
4. Illustrate the concepts of DFT and memory testing.
5. Identify the fault location by diagnosis methods and design self checking circuits..

Text Book(s)

1. Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, “VLSI Test Principles and Architectures: Design for Testability", Morgan Kaufmann publishers, 2006.
2. M.L.Bushnell and V.D.Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2002.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors

20HDECE103 REAL TIME OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

This course emphasize to the students to understand the concepts of real time operating systems (RTOS). This course covers the different types of policies, multi-resource services and give embedded system components. It also covers the High availability and Reliability Design.

Course Objectives:

This course enables students to

1. Understand the introduction of real-time embedded systems
2. Know the different types of policies.
3. Understand the Multi-resource Services techniques.
4. Learn the Embedded System Components.
5. Know the embedded system design based on availability and reliability.

UNIT I INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS 9 hours

Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

UNIT II RTOS POLICIES 9 hours

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.

UNIT III MULTI-RESOURCE SERVICES 9 hours

Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, mixed hard and soft real-time services.

UNIT IV EMBEDDED SYSTEM COMPONENTS 9 hours

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.

UNIT V HIGH AVAILABILITY AND RELIABILITY DESIGN 9 hours

Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design. Design of RTOS – PIC microcontroller.

Course Outcomes:

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

1. Introduce real-time embedded systems
2. Describe the different types of policies.
3. Demonstrate the Multi-resource Services techniques.
4. Explain the Embedded System Components.
5. Explain the embedded system design based on availability and reliability.

Text Book(s)

1. C.M. Krishna and G.Shin, Real Time Systems, McGraw-Hill International Edition, 2017.

2. Jean J Labrosse, Embedded Systems Building Blocks Complete and Ready-to-use Modules in C, CMP books, 2/e, 1999. (reprint 2011

Reference Books

1. Jean J Labrosse, Micro C/OS-II, The Real Time Kernel, CMP Books, 2011.

2. Sam Siewert, V, Real-Time Embedded Components and Systems: With Linux and RTOS (Engineering), 2015.

3. Tanenbaum, Modern Operating Systems, 4th edition, Pearson Edition, 2015.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE104 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

Discrete random process, autocorrelation, autovaiance of the discrete random signal has been covered in the course. The spectrum estimation, linear estimation design included in the course. Also, filter design using adaptive techniques and multi-rate signal processing have been discussed.

Course Objectives:

This course enables students to

1. Understand the discrete random signal processing.
2. Study the spectrum estimation.
3. Understand the linear estimation and prediction.
4. Know the designing of adaptive filter.
5. Study the multi-rate signal processing.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9 hours

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Autocovariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density Periodogram, Spectral Factorization, Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II SPECTRUM ESTIMATION 9 hours

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators-Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin’s algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 9 hours

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9 hours

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9 hours

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- Direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system. Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Course Outcomes:

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

1. Recognise the discrete random signal processing.
2. Demonstrate different spectrum estimation techniques.
3. Realize the linear estimation and prediction.
4. Design the adaptive filter.
5. Analyse the multi-rate signal processing.

Text Book(s)

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons,Inc.,Singapore, 2002.

Reference Books

1. John G.Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
2. John G.Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
3. Dimitris G. Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.
4. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic)

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE105 SYSTEM ON CHIP DESIGN

L	T	P	C
3	0	0	3

Pre-requisite **None**

Course Description:

The system architecture, hardware & software design will be covered using SOC approach. The different processors, memory design for SOC will be covered. Also, the case studies of various applications will be included.

Course Objectives:

This course enables students to

1. Understand the introduction of SOC
2. Know the different types of processors.
3. Understand the memory design of SOC.
4. Learn the interconnect and customization.
5. Know the Application of SOC

UNIT I INTRODUCTION **9 hours**

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT II PROCESSORS **9 hours**

Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT III MEMORY DESIGN FOR SOC **9 hours**

Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

UNIT IV INTERCONNECT CUSTOMIZATION AND CONFIGURATION **9 hours**

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT V APPLICATION STUDIES / CASE STUDIES **9 hours**

SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Course Outcomes:

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

1. Understand the introduction of SOC
2. Know the different types of processors.
3. Understand the memory design of SOC.
4. Learn the interconnect and customization.
5. Know the Application of SOC

Text Book(s)

1. Michael J. Flynn, Wayne Luk, Computer System Design: System on chip, Wiley-Blackwell, First Edition, 2011.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.

Reference Books

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology)", Newnes, BK and CDROM.
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

20HDECE106 VLSI SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite **None**

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 9 hours

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.

UNIT II RETIMING, FOLDING AND UNFOLDING 9 hours

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.

UNIT III FAST CONVOLUTION 9 hours

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.

UNIT IV BIT-LEVEL ARITHMETIC ARCHITECTURES 9 hours

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.

UNIT V PROGRAMMING DIGITAL SIGNAL PROCESSORS 9 hours

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.

Course Outcomes:

Upon successful completion of the course, students 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 Book(s)

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: Continuous Internal Evaluation and End Semester Examination