M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous)

Thalavapalayam, Karur – 639113

Curriculum and Syllabus for ECE

(ELECTRONICS AND COMMUNICATION ENGINEERING)

REGULATION – 2018

(As per Credit Based Semester and Grading System)

VISION AND MISSION OF THE INSTITUTE

Vision

To merge as a leader among the top institutions in the field of technical education

Mission

1. Produce smart technocrats with empirical knowledge who can surmount the global challenges.
2. Create a diverse, fully engaged, learner – centric campus environment to provide quality education to the students.
3. Maintain mutually beneficial partnerships with our alumni, industry and Professional associations.

VISION AND MISSION OF THE DEPARTMENT

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

1. Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects
2. Include the students in problem solving and lifelong learning ability.
3. Provide entrepreneurial skills and leadership qualities.
4. Render the technical knowledge and industrial skills of faculties.

Program Educational Objectives

PEO1: Graduates will have a successful career in academia or industry associated with electronics and communication engineering.

PEO2: Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of electronics and communication engineering.

PEO3: Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

Mapping of Programme Educational Objectives with Mission of the Department:

PEOs/ Department Mission Statements	M1	M2	M3	M4
PEO1	3	3	2	3
PEO2	3	3	2	2
PEO3	2	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Program Outcomes (POs):

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

CURRICULUM AND SYLLABUS
REGULATION 2018

Programme: B.E. – Electronics and Communication Engineering

Structure of Curriculum

Sl.No.	Category	Credits
1	Humanities and Social Sciences including Management courses (H)	12
2	Basic Science courses (B)	26
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.(S)	22
4	Professional core courses (C)	50
5	Professional Elective courses relevant to chosen specialization/branch (E)	27
6	Open Electives –Electives from other technical and /or emerging subjects (O)	09
7	Project work, Minor project, seminar and internship in industry or elsewhere (P)	14
8	Mandatory Courses (M) [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	04
	Total Credits	164

1. Humanities and Social Sciences including Management courses (H)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18LEH101J	Technical English	2	0	2	3
18LEH102J	Professional English	2	0	2	3
18MBH101L	Professional Skills and Practices	0	0	2	1
18MBH102L	General Aptitude	0	0	2	1
18MBH201T	Management Principles for Engineers	2	0	0	2
18MBH202T	Social Engineering	2	0	0	2
				Total Credits	12

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

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2. Basic Science courses (B)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PYB101J	Physics	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB202T	Partial Differential Equations and linear Algebra	3	1	0	4
18MAB205T	Probability Theory and Random Processes	3	1	0	4
				Total Credits	26

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

3. Engineering Science courses including workshop, drawing, basics of Electrical/ Mechanical / Computer etc (S)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MES101J	Engineering Graphics	1	0	4	3
18EES101J(R)	Basic Electrical and Electronics Engineering	3	0	2	4
18MES102J	Basic Civil and Mechanical Engineering	3	0	2	4
18CSS101J(R)	Programming for Problem Solving	2	0	2	3
18ITS201J	Data Structures and object oriented programming	3	0	2	4
18ECS201J	Digital Electronics	3	0	2	4
				Total Credits	22

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ Project

DATE 15 | 10 | 2020

BOS - 9

SEU – unit 1 title may be solar radiation and measurements
PQ – IEEE Standards to be included in unit 2, 3 and 4.

OPen electives.

IoT – No Change
FSM – Interchange the unit 3 & unit 4
Robotics – No change.
ESD & FC – No change.
EV – Course name may be changed as fundamentals of electric vehicles
IoT and ESD & FC subjects can be included in professional electives for EEE Students with different name.

BEEE – The subject content in all the 5 units are revised based on the feedback from the stack holders
One credit course – Board is accepted to conduct three one Credit courses from 5th Semester onwards for this 2018 regulation

BTech (CSBS) – Principles of electrical engineering course content also discussed and verified.

PG 2019 Regulation.

Power System Protection Course may be added as elective course in third Semester
electronics
Analog and digital electronics Subject codes are revised

15/10/2020

2. Basic Science courses (B)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PYB101J	Physics	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB202T	Partial Differential Equations and linear Algebra	3	1	0	4
18MAB205T	Probability Theory and Random Processes	3	1	0	4
				Total Credits	26

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3. Engineering Science courses including workshop, drawing, basics of Electrical/ Mechanical / Computer etc (S)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MES101J	Engineering Graphics	1	0	4	3
18EES101J	Basic Electrical and Electronics Engineering	3	0	2	4
18MES102J	Basic Civil and Mechanical Engineering	3	0	2	4
18CSS101J(R)	Programming for Problem Solving	2	0	2	3
18ITS201J	Data Structures and object oriented programming	3	0	2	4
18ECS201J	Digital Electronics	3	0	2	4
				Total Credits	22

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8.10 Syllabus Revision for 18CSS101J Programming for Problem Solving

- Faculties and Students felt that current syllabus is too heavy. Suggested for reframing the syllabus and accepted for reframing as 2 0 2[Total Credits:3].
- Basics need to be concentrated much through practicals.

MEMBERS PRESENT

1. Dr.A.Kannan - A. Kannan
2. Dr.G.Mohana Prabha - 25/3/19
3. Dr.R.Suganya - 25/3/19
4. Dr.T.Abirami - 25/3/19
5. Ms.Nivetha Ravichandran - R. Nivetha
6. Mr.S.N.Gowtham -
7. Dr.V.Durgadevi - 25/3/19
8. Mr.A.Shanmugavelaytham - A. 25/3/19
9. Mrs.R.Sujatha - R. Sujatha 25/3/19.
10. Mr.M.Gunasekar - 25/3/19
11. Mr.E.Balraj - 25/3/19
12. Mr.S.Vinoth (15BIT2058) - 25/3/19
13. Mr.R.Balaji (16BIT3013) - R. Balaji 25/3/19

14. Ms. B. Sinthiya (PSO Coordinator) - B. Sinthiya 25/3/19

4. Professional Core courses (C)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECC201T	Electromagnetic Fields	3	0	0	3
18ECC202J	Analog Electronics	3	0	2	4
18ECC203T	Measurements and Instrumentation	3	0	0	3
18ECC204T	Network Analysis and Synthesis	3	0	0	3
18ECC205J	Analog Integrated Circuits	3	0	2	4
18ECC206T	Transmission Lines and Waveguides	3	1	0	4
18ECC207T	Signals and Systems	3	1	0	4
18ECC208J	Microprocessor and Microcontroller	3	0	2	4
18ECC301J	Digital signal Processing	3	0	2	4
18ECC302T	Antennas and wave propagation	3	0	0	3
18ECC303T	Analog Communication	3	0	0	3
18ECC304J	Digital communication	3	0	2	4
18ECC305J	Microwave Engineering	3	0	2	4
18ECC401T	Wireless Communication	3	0	0	3
				Total Credits	50

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5. Professional Elective courses relevant to chosen specialization/branch (E)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECE001J	VLSI Design	3	0	2	4
18ECE002J	Embedded System Design	3	0	2	4
18ECE003T	Real Time Operating Systems	3	0	0	3
18ECE004T	Advanced Microprocessors and Microcontrollers	3	0	0	3
18ECE005J	Computer Networks	3	0	2	4
18ECE006T	Automotive Embedded Systems	3	0	0	3
18ECE007T	Testing of VLSI Design	3	0	0	3
18ECE008T	ASIC Design	3	0	0	3
18ECE009J	Internet of Things	3	0	2	4
18ECE010T	Machine Learning	3	0	0	3
18ECE011T	Digital Image Processing	3	0	0	3
18ECE012T	Cognitive Radio	3	0	0	3
18ECE013T	Wireless Embedded Systems	3	0	0	3
18ECE014T	High Speed Networks	3	0	0	3
18ECE015T	Biomedical Instrumentation	3	0	0	3
18ECE016T	Sensors & Actuators	3	0	0	3
18ECE017T	Control Systems	3	0	0	3
18ECE018T	Medical Image Processing	3	0	0	3
18ECE019T	PCB Design Engineering	3	0	0	3
18ECE020T	Industrial Automation	3	0	0	3
18ECE021J	Fiber Optic Communication	3	0	2	4
18ECE022T	Robotics & Automation	3	0	0	3
18ECE023T	Wireless Networks	3	0	0	3
18ECE024T	Optical Networks	3	0	0	3

18ECE025T	Cryptography and Network Security	3	0	0	3
18ECE026T	High Performance Communication Networks	3	0	0	3
18ECE027T	LORA WAN	3	0	0	3
18ECE028T	Adhoc and Sensor Networks	3	0	0	3
18ECE029T	Satellite Communication	3	0	0	3
18ECE030T	Radar and Navigational Aids	3	0	0	3
18ECE031T	Space Time Wireless Communication	3	0	0	3
18ECE032T	Pattern Recognition	3	0	0	3
18ECE033T	Multimedia Compression Techniques	3	0	0	3
18ECE034T	Nanotechnology	3	0	0	3
18ECE035T	MEMS	3	0	0	3
				Total Credits	**27**

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

2. PG (Communication Systems)

2.1. To finalize the syllabus of 3rd, 4th semester syllabus – R2019

- Wireless Embedded Systems, Remote Sensing, PCB design Technology, Communication Interfaces – No changes required in the syllabus content, check for CO-PO mapping

General Suggestions

- Course outcomes and CO-PO mapping needs to be matched properly.
- Over all Grouping of electives can be made and also based on the credits, which can be offered in any semesters. Some electives with 3 and some are with 4 credits. Hence, electives with 4 credits need to be grouped and offered to students for any one elective course.
- General aptitude, career skills and creative thinking course can be made as mandatory and credits can be utilized for some core courses
- VLSI, Embedded systems can be brought under core courses, If the proposed curriculum does not permit to convert as core, they need to be made as compulsory.
- Reduce theory and increase laboratory contents
- For physics and chemistry credits can be reduced to 4
- Measurement and Instrumentation can be made as elective
- Minor projects one per year is enough so that credits can be saved
- Can include k levels for the course
- Subjects relating to Communication and Electronics should be of equal
- MOOC/NPTEL based course Credits must be allocated as per credits offered by them instead, we fix it as 1 credit.
- Novelty is required in lab experiments which to be seek by the industries.

12/10/2020

Dr. C.VIVEK, B.E., M.Tech., Ph.D
Professor & Head
Department of ECE
M.Kumarasamy College of Engineering
Thalavapalayam, Karur - 639 113.

5.Professional Elective courses relevant to chosen specialization/branch (E)

Course Code	Course Name	Hours / Week			C
		L	T	P	
V-Semester					
18ECE001J	VLSI Design	3	0	2	4
18ECE002J	Embedded System Design	3	0	2	4
18ECE003T	Real Time Operating Systems	3	0	0	3
18ECE004T	Advanced Microprocessors and Microcontrollers	3	0	0	3
18ECE005J	Computer Networks	3	0	2	4
VI-Semester					
18ECE006T	Automotive Embedded Systems	3	0	0	3
18ECE007T	Testing of VLSI Design	3	0	0	3
18ECE008T	ASIC Design	3	0	0	3
18ECE009J	Internet Of Things	3	0	2	4
18ECE010T	Machine Learning	3	0	0	3
18ECE011T	Digital Image Processing	3	0	0	3
18ECE012T	Cognitive Radio	3	0	0	3
18ECE013T	Wireless Embedded Systems	3	0	0	3
VII -Semester					
18ECE014T	High Speed Networks	3	0	0	3
18ECE015T	Biomedical Instrumentation	3	0	0	3
18ECE016T	Sensors & Actuators	3	0	0	3
18ECE017T	Control Systems	3	0	0	3
18ECE018T	Medical Image Processing	3	0	0	3
18ECE019J	PCB Design Engineering	3	0	0	3
18ECE020T	Industrial Automation	3	0	0	3
18ECE021J	Fiber Optic Communication	3	0	2	4
18ECE022T	Robotics & Automation	3	0	0	3

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VIII-Semester					
18ECE023T	Wireless Networks	3	0	0	3
18ECE024T	Optical Networks	3	0	0	3
18ECE025T	Cryptography and Network Security	3	0	0	3
18ECE026T	High Performance Communication Networks	3	0	0	3
18ECE027T	LORA WAN	3	0	0	3
18ECE028T	Adhoc and Sensor Networks	3	0	0	3
18ECE029T	Satellite Communication	3	0	0	3
18ECE030T	Radar and Navigational Aids	3	0	0	3
18ECE031T	Space Time wireless communication	3	0	0	3
18ECE032T	Pattern Recognition	3	0	0	3
18ECE033T	Multimedia Compression Techniques	3	0	0	3
18ECE034T	Nanotechnology	3	0	0	3
18ECE035T	MEMS	3	0	0	3
				Total Credits	24

T-Lecture T-Lecture+ Tutorial L-Practical, Project, J- Lecture+ project

6. Open electives offered to other departments by the Electronics and Communication Engineering department (O)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECO001T	Microcontrollers and Embedded systems	3	0	0	3
18ECO002T	Internet of Everything	3	0	0	3
18ECO003T	Wireless Mobile Communication	3	0	0	3
18ECO004T	Medical Engineering	3	0	0	3
18ECO005T	Signal and Image Processing	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Electives Offered by Civil Engineering Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18CEO001T	Building Services	3	0	0	3
18CEO002T	Disaster Preparedness, Planning and Management	3	0	0	3
18CEO003T	Environmental Impact Assessment	3	0	0	3
18CEO004T	Remote Sensing and GIS	3	0	0	3
18CEO005T	Metro System and Engineering	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Elective Offered by CSE Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18CSO001T	Basics of Data Structures and Algorithms	3	0	0	3
18CSO002J	Fundamentals of Python Programming	2	0	2	3
18CSO003J	Fundamentals of Java Programming	2	0	2	3
18CSO004J	Mobile Application Development	2	0	2	3
18CSO005T	Software Development using Agile	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

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Open Elective Offered by EEE Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EEO001T	Basics of Internet of Things	3	0	0	3
18EEO002T	Fundamentals of Smart Grid	3	0	0	3
18EEO003T	Robotics	3	0	0	3
18EEO004T	Energy Storing Devices	3	0	0	3
18EEO005T	Fundamentals of Electric Vehicles	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Elective Offered by EIE Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EIO001T	Basics of Automation	3	0	0	3
18EIO002T	Automotive Electronics	3	0	0	3
18EIO003T	Programmable Logic Controllers	3	0	0	3
18EIO004T	Introduction to MEMS	3	0	0	3
18EIO005T	Smart Sensor Technology	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Elective Offered by IT Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ITO001J	Problem Solving Techniques Using Python	1	0	4	3
18ITO002J	Java Programming	1	0	4	3
18ITO003J	Game Design and Development	1	0	4	3
18ITO004J	Web Design	2	0	2	3
18ITO005J	Data Structures	2	0	2	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Elective Offered by Mechanical Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MEO001T	Industrial Safety for Engineers	3	0	0	3
18MEO002T	Energy Engineering	3	0	0	3
18MEO003T	Automobile Technology	3	0	0	3
18MEO004T	Advances in Nanotechnology	3	0	0	3
18MEO005T	Product Design and Development	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

Open Elective Offered by MBA Department

Course Code	Course Name	Hours / Week			C
		L	T	P	
18BMBO001T	Business Ethics and Corporate Social Responsibility	3	0	0	3
18BMBO002T	Human Capital Management	3	0	0	3
18BMBO003T	Digital and Social Media Marketing	3	0	0	3
18BMBO004T	Banking Principles and Practices	3	0	0	3
18BMBO005T	Export Management and Documentation	3	0	0	3
				Total Credits	15

T-Lecture T-Lecture+Tutorial L-Practical, Project, J-Lecture+Project

7. Project work, minor project, seminar and internship in industry or elsewhere (P)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECP101N	MOOC I / Industrial Training I	0	0	2*	1
18ECP102N	MOOC II / Industrial Training II	0	0	2*	1
18ECP103L	Minor Project I	0	0	2	1
18ECP104L	Minor Project II	0	0	2	1
18ECP105L	Minor Project III	0	0	2	1
18ECP106L	Minor Project IV	0	0	2	1
18ECP107L	Project work / Semester Internship	0	0	16	8
				Total Credits	14

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project
*can be conducted as non-conducted hours

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8. Mandatory Courses (M)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18LEM101T	Constitution of India	1	0	0	Nil
18LEM102T	Value Education	1	0	0	Nil
18GNM101L	Physical and Mental Health using Yoga	0	0	2	Nil
18GNM102L	NSS	0	0	2	Nil
18MBM201L	Competencies in Social Skills	0	0	2	1
18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
18CYM201T	Environmental Science	1	0	0	Nil
18LEM103T	Indian Tradition and Heritage	1	0	0	Nil
18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
18MBM302L	Employability Skills and Practices	0	0	2	1
18LEM301T	Indian Art Forms	1	0	0	Nil
18LEM302T	Self Development and Entrepreneurship	1	0	0	Nil
				Total Credits	04

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

9.One Credit Courses (X)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECX001T	Modern Electronic Instrumentation	1	0	0	1
18ECX002T	Next Generation Wireless Systems and Networks	1	0	0	1
18ECX003T	Android App Development	1	0	0	1
18CSX005T	Data Center and Cloud Basics	1	0	0	1
				Total Credits	03

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ Project

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12 OCT 2020
KARUR - 639 113

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NAAC Accredited Autonomous Institution
Approved by AICTE & Affiliated to Anna University
ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

TCS one credit course approved in 9th BOS meeting of CSE.

Regulation 2016:

Course Code	Course Name	Credit
16CSY10	Data Center and Cloud Basics	1

Regulation 2018:

Course Code	Course Name	Credit
18CSX005T	Data Center and Cloud Basics	1

M.KUMARASAMY COLLEGE OF ENGG.(AUTONOMOUS)
Approved By
Board of Computer Science On
27 OCT 2020
KARUR - 639 113

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COLLEGE OF ENGINEERING
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ISO 9001:2015 & ISO 14001:2015 Certified Institution
Thalavapalayam, Karur - 639 113.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BOARD OF STUDIES (VIRTUAL MEETING)

DATE: 27.10.2020 **MEETING.NO : 09**

TIME : 11.30 AM

Minutes of the Meeting

9.1 Highlights of the Institution is presented by the board chairman.

9.2 Highlights of the Department is presented by the board chairman.

9.3 Confirmation of the minutes of 8thBOS Meeting held on 11.03.2019

- The minutes of 8th Board of Studies Meeting held on 11.03.2019 was confirmed

9.4 Discussion on – Agile Methodology – TCS recommended Industry Elective course

- Syllabus content framed and offered by TCS end, is presented in the discussion forum.
- The members felt that the content is well framed and the students will really get an exposure on project development using 'Jile'.

9.5 Discussion on one credit courses offered by the department and the one credit course offered by TCS – Data Center and Cloud Basics

- The following one credit courses presented are verified and suggested to offer for computer science and engineering students(Curriculum- R2018).
  - ✓ Animations
  - ✓ Problem Solving using C++
  - ✓ ReactJS
  - ✓ Statistical Analysis using R
  - ✓ Data Center and Cloud Basics
  - ✓ Ethics in Cyber Security
  - ✓ MongoDB
- Data Center and Cloud Basics content framed by TCS is presented and is recommended by all members to offer as an one credit course (Curriculum- R2016 and R2018) for Computer Science and Engineering and other Engineering stream students also.

9.6 Discussion on B.E – CSE – Regulation 2018 – Syllabus for 5th to 8th Semester Courses

- The members verified the syllabus from 5th semester to 8th semester courses of regulation 2018

3. Business Intelligence and its Applications
4. Insight into Cloud Computing
5. Developing Web Applications in .NET
6. Internet of Things
7. Introduction to Mainframes
8. Machine Learning
9. Mobile Application Development
10. Soft Skills
11. Software Testing
12. User Interface Technologies - Part I
13. User Interface Technologies - Part II

- Among the above courses, the members recommended the below list of courses to be included in the curriculum suitably as a Professional Core / Elective

1. Big Data and Analytics
2. Building Enterprise Applications
3. Insight into Cloud Computing
4. Developing Web Applications in .NET
5. Internet of Things
6. Software Testing
7. User Interface Technologies - Part I
8. User Interface Technologies - Part II

9.8 Discussion on Open Elective Courses - Syllabus for other Engineering Stream students

- The members suggested to include Software Engineering fundamental concepts in the first unit of Software Development using Agile.

9.9 Any other points raised by the members

- The members recommended to include one course related to Linux programming, since it has got a high impact on working environment both Industry / Academia at abroad.

Dr.S.Thilagamani
Chairman-Board of Studies - CSE

Dr. S. THILAGAMANI, M.E., Ph.d.,
Professor, HoD & Dean,
Computer Science & Engineering
M. Kumarasamy College of Engineering
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8. Mandatory Courses (M)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18LEM101T	Constitution of India	1	0	0	Nil
18LEM102T	Value Education	1	0	0	Nil
18GNM101L	Physical and Mental Health using Yoga	0	0	2	Nil
18GNM102L	NSS	0	0	2	Nil
18MBM201L	Competencies in Social Skills	0	0	2	1
18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
18CYM201T	Environmental Science	1	0	0	Nil
18LEM103T	Indian Tradition and Heritage	1	0	0	Nil
18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
18MBM302L	Employability Skills and Practices	0	0	2	1
18LEM301T	Indian Art Forms	1	0	0	Nil
18LEM302T	Self Development and Entrepreneurship	1	0	0	Nil
				Total Credits	04

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ project

9.One Credit Courses (X)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18ECX001T	Modern Electronic Instrumentation	1	0	0	1
18ECX002T	Next Generation Wireless Systems and Networks	1	0	0	1
18ECX003T	Android App Development	1	0	0	1
				Total Credits	03

T-Lecture T-Lecture+Tutorial L-Practical, Project J- Lecture+ Project

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SEMESTER I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J / 18EES101J(R)	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L	Professional Skills and Practices	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health Using Yoga / NSS	0	0	2	Nil
					Total Credits	20

SEMESTER II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J / 18EES101J(R)	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH102L	General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health Using Yoga / NSS	0	0	2	Nil
					Total Credits	20

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I to VIII Semester Curriculum

Semester I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

Semester II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

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I to VIII Semester Curriculum

Semester I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J	Engineering Graphics / Programming for Problem Solving	1	0	4	3
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

Semester II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J	Engineering Graphics / Programming for Problem Solving	1	0	4	3
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

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SEMESTER III						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB202T	Partial Differential Equations and Linear Algebra	3	1	0	4
S	18ECS201J	Digital Electronics	3	0	2	4
C	18ECC201T	Electromagnetic Fields	3	0	0	3
C	18ECC202J	Analog Electronics	3	0	2	4
C	18ECC203T	Measurements and Instrumentation	3	0	0	3
C	18ECC204T	Network Analysis and Synthesis	3	0	0	3
P	18ECP103L	Minor Project I	0	0	2	1
M	18MBM201L	Competencies in Social Skills	0	0	2	1
M	18CYM201T/ 18LEM103T	Environmental Science/ Indian Tradition and Heritage	1	0	0	Nil
					Total Credits	23

SEMESTER IV						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB205T	Probability Theory and Random Processes	3	1	0	4
S	18ITS201J	Data Structures and Object Oriented Programming	3	0	2	4
C	18ECC205J	Analog Integrated Circuits	3	0	2	4
C	18ECC206T	Transmission lines and waveguides	3	1	0	4
C	18ECC207T	Signals and Systems	3	1	0	4
C	18ECC208J	Microprocessor and Microcontroller	3	0	2	4
P	18ECP104L	Minor Project II	0	0	2	1
M	18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
M	18CYM201T /18LEM103T	Environmental Science / Indian Tradition and Heritage	1	0	0	Nil
					Total Credits	26

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SEMESTER V						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC301J	Digital signal Processing	3	0	2	4
C	18ECC302T	Antennas and Wave propagation	3	0	0	3
C	18ECC303T	Analog Communication	3	0	0	3
E		Professional Elective – 1	3	0	2	4
E		Professional Elective – 2	3	0	0	3
O		Open Elective – 1	3	0	0	3
P	18ECP105L	Minor Project III	0	0	2	1
P	18ECP101N	MOOC I / Industrial Training I	0	0	2	1
M	18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
M	18LEM301T/ 18LEM302T	Indian Art Forms/Self Development and Entrepreneurship	1	0	0	Nil
					Total Credits	23

SEMESTER VI						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH201T	Management Principles for Engineers	2	0	0	2
C	18ECC304J	Digital communication	3	0	2	4
C	18ECC305J	Microwave Engineering	3	0	2	4
E		Professional Elective – 3	3	0	2	4
E		Professional Elective – 4	3	0	0	3
O		Open Elective – 2	3	0	0	3
P	18ECP106L	Minor Project IV	0	0	2	1
P	18ECP102N	MOOC II / Industrial TrainingII	0	0	2	1
M	18MBM302L	Employability Skills and Practices	0	0	2	1
M	18LEM301T/ 18LEM302T	Indian Art Forms / Self Development and Entrepreneurship	1	0	0	Nil
					Total Credits	23

SEMESTERVII						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH202T	Social Engineering	2	0	0	2
C	18ECC401T	Wireless Communication	3	0	0	3
E		Professional Elective – 5	3	0	2	4
E		Professional Elective – 6	3	0	0	3
O		Open Elective – 3	3	0	0	3
					Total Credits	15

SEMESTERVIII						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18ECP107L	Project work	0	0	16	8
E		Professional Elective – 7	3	0	0	3
E		Professional Elective – 8	3	0	0	3
					Total Credits	14

T-Lecture T-Lecture+Tutorial L-Practical, Project J-Lecture+Project

Category / Semester	I	II	III	IV	V	VI	VII	VIII	Category wise Total Credits
Science and Humanities (H)	04	04	-	-	-	02	02	-	12
Basic Sciences (B)	09	09	04	04	-	-	-	-	26
Engg Science (S)	07	07	04	04	-	-	-	-	22
Professional Core (C)	-	-	13	16	10	08	03	-	50
Professional Elective (E)	-	-	-	-	07	07	07	06	27
Open Elective (O)	-	-	-	-	03	03	03	-	09
Project Work (P)	-	-	01	01	02	02	-	08	14
Mandatory Course (M)	-	-	01	01	01	01	-	-	04
Semester Wise Total Credits	**20**	**20**	**23**	**26**	**23**	**23**	**15**	**14**	**164**

Programme Articulation

Semester	Course Code	Course Name	POs											PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	18LEH101J	Technical English	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
1	18MBH101L	Professional Skills and Practices						✓	✓	✓	✓	✓	✓	✓		✓
1	18MAB101T	Calculus and Linear Algebra	✓	✓	✓	✓	✓				✓			✓	✓	✓
1	18PYB101J	Physics	✓	✓	✓	✓									✓	✓
1	18CSS101J(R)	Programming for Problem Solving	✓	✓							✓	✓		✓	✓	✓
1	18MES102J	Basic Civil and Mechanical Engineering	✓		✓		✓	✓	✓		✓			✓		
1	18LEM101T	Constitution of India							✓	✓	✓	✓	✓	✓		
1/2	18GNM101L	Physical and Mental Health using Yoga						✓						✓		
2	18LEH102J	Professional English	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
2	18MBH102L	General Aptitude	✓	✓		✓	✓				✓	✓	✓	✓		
2	18MAB102T	Advanced Calculus and Complex Analysis	✓	✓	✓	✓	✓				✓			✓	✓	✓
2	18CYB101J	Chemistry	✓	✓		✓										
2	18MES101J	Engineering Graphics	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
2	18EES101J	Basic Electrical and Electronics Engineering	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓
2	18LEM102T	Value Education	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓
3	18MAB202T	Partial Differential Equations and linear Algebra	✓	✓	✓	✓									✓	✓
3	18ECS201J	Digital Electronics	✓	✓	✓	✓	✓				✓			✓	✓	✓
3	18ECC201T	Electromagnetic Fields	✓	✓	✓	✓			✓		✓			✓	✓	✓
3	18ECC202J	Analog Electronics	✓	✓	✓			✓	✓		✓	✓		✓	✓	✓
3	18ECC203T	Measurements and	✓	✓	✓		✓	✓	✓						✓	✓

Semester	Course Code	Course Name	POs												PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Instrumentation														
3	18ECC204T	Network Analysis and Synthesis	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
3	18ECP103L	Minor Project – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	18MBM201L	Competencies in Social Skills	✓								✓	✓			✓	✓
3/4	18CYM201T	Environmental Science		✓		✓		✓	✓	✓						
4	18MAB205T	Probability Theory and Random Processes	✓	✓	✓	✓									✓	✓
4	18ITS201J	Data Structures and object oriented programming	✓	✓		✓	✓			✓	✓	✓			✓	✓
4	18ECC205J	Analog Integrated circuits	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
4	18ECC206T	Transmission lines and waveguides	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓
4	18ECC207T	Signals and Systems	✓	✓	✓	✓		✓						✓	✓	✓
4	18ECC208J	Microprocessor and Microcontroller	✓	✓	✓	✓	✓			✓	✓			✓	✓	✓
4	18ECP104L	Minor Project – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	18MBM202L	Critical and Creative Thinking Skills	✓									✓				
3/4	18LEM103T	Indian Tradition and Heritage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
5	18BECC301J	Digital signal Processing	✓	✓	✓	✓	✓		✓			✓		✓	✓	✓
5	18BECC302T	Antennas and Wave propagation	✓	✓	✓	✓					✓		✓	✓	✓	✓
5	18BECC303T	Analog Communication	✓	✓	✓	✓					✓				✓	✓
5	18BECP105L	Minor Project – III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	18MBM301L	Analytical and Logical Thinking Skills	✓								✓	✓				

Semester	Course Code	Course Name	POs												PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5/6	18LEM302T	Self Development and Entrepreneurship	✓	✓				✓	✓	✓	✓	✓	✓	✓		
6	18MBH201T	Management Principles for Engineers	✓	✓				✓			✓	✓	✓	✓		
6	18BECC304J	Digital communication	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
6	18BECC305J	Microwave Engineering	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓
6	18ECP106L	Minor Project – IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	18MBM302L	Employability Skills and Practices	✓								✓	✓				
5/6	18LEM301T	Indian Art Forms						✓	✓	✓	✓	✓		✓		
7	18MBH202T	Social Engineering	✓	✓				✓	✓	✓	✓	✓		✓		
7	18ECC401T	Wireless Communication	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
8	18ECP107L	Project work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Professional Electives																
-	18ECE001J	VLSI Design	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓
-	18ECE002J	Embedded System Design	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓
-	18ECE003T	Real Time Operating Systems	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓
-	18ECE004T	Advanced Microprocessors and Microcontrollers	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓
-	18ECE005J	Computer Networks	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
-	18ECE006T	Automotive Embedded Systems	✓	✓	✓		✓		✓	✓	✓		✓		✓	✓
-	18ECE007T	Testing of VLSI Design	✓	✓	✓	✓								✓	✓	✓
-	18ECE008T	ASIC Design	✓	✓	✓	✓	✓							✓	✓	✓
-	18ECE009J	Internet of Things	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
-	18ECE010T	Machine Learning	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓

Semester	Course Code	Course Name	POs												PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
-	18ECE011T	Digital Image Processing	✓	✓	✓	✓			✓					✓	✓	✓
-	18ECE012T	Cognitive Radio	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓
-	18ECE013T	Wireless Embedded Systems	✓	✓	✓	✓								✓	✓	✓
-	18ECE014T	High Speed Networks	✓	✓	✓	✓					✓			✓	✓	✓
-	18ECE015T	Biomedical Instrumentation	✓	✓	✓							✓		✓	✓	✓
-	18ECE016T	Sensors & Actuators	✓	✓	✓	✓						✓		✓	✓	✓
-	18ECE017T	Control Systems	✓	✓	✓			✓		✓					✓	✓
-	18ECE018T	Medical Image Processing	✓	✓	✓	✓								✓	✓	✓
-	18ECE019J	PCB Design Engineering	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓
-	18ECE020T	Industrial Automation	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
-	18ECE021J	Fiber Optic Communication	✓	✓	✓	✓	✓					✓		✓	✓	✓
-	18ECE022T	Robotics & Automation	✓	✓				✓		✓			✓		✓	✓
-	18ECE023T	Wireless Networks	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓
-	18ECE024T	Optical Networks	✓	✓	✓	✓	✓						✓		✓	✓
-	18ECE025T	Cryptography and Network Security	✓	✓	✓	✓						✓		✓	✓	✓
-	18ECE026T	High Performance Communication Networks	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
-	18ECE027T	LORA WAN	✓	✓	✓		✓		✓	✓	✓		✓		✓	✓
-	18ECE028T	Adhoc and Sensor Networks	✓	✓	✓		✓							✓	✓	✓
-	18ECE029T	Satellite Communication	✓	✓	✓	✓		✓	✓		✓			✓	✓	✓
-	18ECE030T	Radar and Navigational Aids	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
-	18ECE031T	Space Time wireless communication	✓	✓	✓	✓	✓			✓	✓				✓	✓
-	18ECE032T	Pattern Recognition	✓	✓	✓	✓								✓	✓	✓

Semester	Course Code	Course Name	POs												PSOs	
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
-	18ECE033T	Multimedia Compression Techniques	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
-	18ECE034T	Nanotechnology	✓	✓	✓	✓								✓	✓	✓
-	18ECE035T	MEMS	✓	✓	✓	✓								✓	✓	✓
Open Electives																
-	18ECO001T	Microcontroller and Embedded Systems	✓	✓	✓		✓	✓			✓	✓		✓		
-	18ECO002T	Internet of Everything	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		
-	18ECO003T	Wireless Mobile Communication	✓	✓	✓	✓		✓					✓	✓		
-	18ECO004T	Medical Engineering	✓	✓	✓	✓										
-	18ECO005T	Signal and Image Processing	✓	✓	✓	✓					✓			✓		
One Credit Courses																
-	18ECX001T	Modern Electronic Instrumentation	✓	✓	✓									✓	✓	✓
-	18ECX002T	Next Generation Wireless Systems and Networks	✓	✓	✓									✓	✓	✓
-	18ECX003T	Android APP Development	✓		✓									✓	✓	✓

Regulation 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	TECHNICAL ENGLISH	2	0	2	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Analyze the importance of communication in personal, professional contexts. Identify proper English pronunciation
CLR-2	Strengthen vocabulary and grammar. Enhance listening and writing comprehension. Review films and documentaries
CLR-3	Writing brief paragraphs using appropriate techniques. Enhance their English fluency in speaking
CLR-4	Write effective essays, stories. Experience workplace communication aspects
CLR-5	Research on a topic and write a comprehensible academic project reports. Make effective presentations

Course Outcome (s) (COs):

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

CO1	Identify types, modes, channels and barriers of communication. distinguish different speech sounds, pronounce correctly
CO2	Identify, rectify the errors in the use of grammar and vocabulary. Improve listening and writing skills
CO3	Develop a topic idea into a cohesive paragraph with examples. Improve the fluency of speaking skills
CO4	Develop ideas into logical and coherent essays. Understand better the workplace culture
CO5	Identify the steps involved in writing an academic project report. List and practice skills need for making a presentation

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO2	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO3	1	3	1	3	3	2	1	3	3	3	-	3	-	-	-
CO4	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO5	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO (Avg)	1	3	1	3	3	2.8	1	3	3	3	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	COMMUNICATION	6

Definition, Process of communication - (Filling in-Class Worksheets) - Verbal and Non-Verbal Communication(Individual and Group Activities - Role play)-Other Types of Communication: General-Technical-Formal, Informal- External, Internal (Write upon a selected type of communication)- Listening, Speaking, Reading, Writing(Group activity (Newspaper) – Discussion and Feedback)- Communication and Language Barriers(Individual Activity- Sharing of Personal Experiences)-Body language(Mime).

UNIT II	VOCABULARY AND GRAMMAR	7

Words with Foreign Roots, Word Formation – Inflectional, Derivational Prefixes, Suffixes(Quiz - Identifying the Borrowed roots and Their Meanings-Worksheet Exercise)-Synonyms and Antonyms and Standard Abbreviations(Context Based Activity / Learner Compiling Standard Abbreviations from Core Subject)-Homonyms and Homophones(Fun Activities – Worksheets- Cross Words)-Articles, Tenses(Exercise through Worksheets- Individual Activity -Peer Correction- Open Discussion)- Noun-Pronoun Agreement and Subject-Verb Agreement(Identifying and Learning through Error Analysis – Worksheets)-Misplaced Modifiers - Prepositions- Prepositional verbs and Phrasal verbs(Learn through Practice – Placing Same Modifier in Different Places in a Sentence)-Prepositions- Prepositional Verbs and Phrasal Verbs(Filling in-Class Worksheets)

UNIT III	DISCOURSE TECHNIQUES	7

Sentence Structure, Phrases and Clauses(Exercise: Worksheet, Identifying Phrases, Clauses, Compound, Complex Sentences)-Developing Ideas into Paragraphs –Cohesion Markers(Identify Topic sentence in a Paragraph; Writing a Paragraph Based on a Topic)- -Inputs on Writing Precisely, Redundancies, Wordiness-Repetition-Clichés(Error Analysis and Editing)-Defining, Describing Technical Terms(Writing Definitions-Product and Process Description)-Inputs on Classifying/Categorising and Sequencing Ideas with Relevant Diagrams(Writing a Passage on the Given hints, Tree Diagram, Classification Table and Flow Chart)-Importance of Punctuation – Miscommunication –(Fun Activities - Worksheets for Appropriate Punctuation – Written)- Errors in Punctuation(Fun Activities - Worksheets for Appropriate Punctuation – Written)

UNIT IV	WORKPLACE COMMUNICATION	6

Reading Comprehension, Guidelines questions (Referential, Critical,Interpretative)(Practice Excercise) - Précis-writing Guidelines(Practice Excercise) - Summarising(Group Activity (Oral/Written) on the Given Passages)-Essay Writing Guidelines: Introduction, Elaboration and Conclusion with Examples(Individual Activity (Written) on the Given Topic)-Organisational Report Writing - Progress Report- Guidelines(Writing a Progress Report)-Interview Skills(Mock Interview).

UNIT V	PROJECT WRITING	5

Topics for Project Writing(Discussion)- Collection of Data – Avoiding Plagiarism-Authenticity and Credibility of Data(Collection of Data for Verification)- Guidelines for Writing: Outline- Objectives-Background- Methodology-Discussion-Documentation(Drafting an Outline & Preparing References)-Discussion Using Sample Project(Writing the First Draft on the Selected Topic)-Checklist for Project Format (PPT)(Self-Verification and Submission of Final Draft).

LIST OF EXPERIMENTS	14

1. Often Mispronounced sounds (Audio Visual Material - Listening to minimal pairs and reproducing)
2. Barriers of communication Language barriers – videos (Identifying the Language Barriers of communication –Written)
3. Short Biographical Account on Famous Personalities –Video(Oral Paraphrasing of the Content Shown)
4. Listening to Long Conversations, Daily Life (Identify Various Communication Contexts and Answering Questions – Collocation)
5. Introduction to Englishes -British and American –Videos (Discussion on Difference between British

and American Words)

6. Speaking - Practice Activity – Brain Storming – Mind Mapping (Just a Minute)
7. Describing a Scene or Event –Videos (String Narration – Describing an Event or a Scene)
8. Technical Communication – Interpreting Data (Group Activity - Interpretation of Data - Oral Presentation)
9. Sample Case Studies for Work Ethics – Videos (Debate on the Videos Shown)
10. Learning Interview Techniques through Models (Mock Interview)
11. Guidelines for Preparing a PPT; Presentation Techniques (Preparing PPT on the Topic of Learners' Choice)
12. Formal Presentation

Text Book (s)	
1	Abirami K ,Technical English –, R.K.Publishers, Coimbatore.
Reference (s)	
1	Swan, Michael. Practical English Usage. OUP, 1995
2	Kumar Sanjay and PushpaLata. Communication Skills. OUP, 2011
3	CIEFL, Hyderabad. Exercises in Spoken English. Parts I-III. OUP
4	Anbazhagan K, Cauveri B, Devika M.P., English for Engineers. Cengage, 2016
5	www.mmm.english.com
6	www.onlinewriting.com/purdue
7	www.ieee.org/index.html

Regulation 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB101T	CALCULUS AND LINEAR ALGEBRA	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Apply the Matrices in problems of Science and Engineering
2	Utilize Taylor series, Maxima minima and Jacobian in solving real- time application problems
3	Utilize the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering
4	Apply the concept of Differential Equations in problems of Science and Engineering
5	Applications of Sequences and Series in all problems involving Science and Engineering

Course Outcome (s) (Cos):

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

CO1	Apply Matrices, Eigenvalues and Eigen Vectors and Reduction of Quadratics form in Science and Engineering problem solving
CO2	Apply Maxima and Minima, Jacobian, and Taylor series to solve problems in Science and Engineering
CO3	Identify Radius, Centre, envelope and Circle of curvature and apply them in the problem solving
CO4	Solve the different types of Differential Equations in Science and Engineering applications
CO5	Apply convergence and divergence of series using different tests and apply sequences and Series in the problem solving

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	3	-	-	3	-	-	-
CO2	3	-	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	3	-	-	3	-	-	-
CO4	-	3	-	-	-	-	-	-	3	-	-	3	-	-	-
CO5	-	3	3	-	-	-	-	-	3	-	-	3	-	-	-
CO (Avg)	3	3	3	3	3	-	-	-	3	-	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	EIGEN VALUE PROBLEMS	9 + 3
Characteristic equation- Cayley-Hamilton theorem (excluding proof)- Eigen values and Eigen vectors of a real matrix – Properties- Orthogonal transformation of a symmetric matrix to diagonal form-Quadratic form-Reduction of quadratic form to canonical form by orthogonal transformation.		
UNIT II	**FUNCTIONS OF SEVERAL VARIABLES**	**9 + 3**
Partial derivatives-Euler's theorem for homogenous functions-Total derivatives-Differentiation of implicit functions-Jacobians-Taylor's expansion-Maxima and Minima-Method of Lagrangian multipliers.		
UNIT III	**APPLICATIONS OF DIFFERENTIAL CALCULUS**	**9 + 3**
Curvature and Radius of curvature – Circle of curvature and Centre of curvature-Envelope- Evolute as Envelope of Normals.		
UNIT IV	**DIFFERENTIAL EQUATIONS OF SECOND ORDER**	**9 + 3**
Second order linear differential equations with constant coefficients- Particular Integrals for x^n, e^{ax}, cosax/sinax, e^{ax}cosbx/e^{ax}sinbx - Method of variation of parameters-Cauchy and Legendre's linear equation-Simultaneous first order linear equations with constant coefficients.		
UNIT V	**SEQUENCES AND SERIES**	**9 + 3**
Sequences: Definition and examples-Series : Types and Convergence - Series of positive terms-Test of convergence: Comparison test, D'Alembert's ratio test, Integral test, Rabee's Root test and Log test-Alternating series-Leibnitz's test-Series of positive and negative terms(Alternating series)-Absolute and Conditional convergence.		

Text Book (s)

1	B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Reference (s)

1	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008
2	N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008
3	G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson,Reprint, 2002
4	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010

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Regulation 2018		SemesterI/Semester II	Total Hours			90
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18PYB101J	PHYSICS	3	1	2	5

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Identify the applications of electric field on materials
CLR-2	Identify the applications of magnetic field on materials
CLR-3	Identify the significance of quantum theory
CLR-4	Create insights to the concepts of optical effects
CLR-5	Analyze the working principle of lasers and optical fibers

Course Outcome (s) (Cos):
At the end of this course, learners will be able to:

CO1	Identify the effect of charge dynamics
CO2	Analyze electromagnetic induction
CO3	Apply quantum mechanics to basic physical problems
CO4	Apply ray propagation and optical effects
CO5	Identify the applications of lasers and optical fiber

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	3.00	3.00	3.00	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ELECTROSTATICS AND DIELECTRIC MATERIALS	9+3

Del-divergence-curl and gradient operations in vector calculus-Gauss-divergence and Stoke's theorem-Electric field and electrostatic potential for a charge distribution-Gauss' law and its applications-Laplace's equations for electrostatic potential-Poisson's equations for electrostatic potential-Solving Problems-Concepts of electric current-Continuity equation-Laws of magnetism-Faraday's law-Ampere's law-Maxwell's equations-Solving Problems-Polarizations, permeability and dielectric constant -Polar and non-polar dielectrics -Types of polarization-Frequency and temperature dependence-Internal field in a field-Clausius-Mossotti equation-Solving Problems.

UNIT II	MAGNETIC AND SUPERCONDUCTING MATERIALS	9+3

Magnetization, permeability and susceptibility-Classification of magnetic materials-Ferromagnetism-Concepts of ferromagnetic domains –Hysteresis-Solving Problems -Properties and applications of ferromagnetic materials Hard and soft magnetic materials -Ferrimagnetic materials - Magnetic bubbles – Ferrites- Solving Problems-Superconductivity -Properties of superconductivity -Type I & Type II superconductors-High Tc superconductors – SQUID – CRYOTRON-MAG LEV-Solving Problems.

UNIT III	QUANTUM PHYSICS	9+3

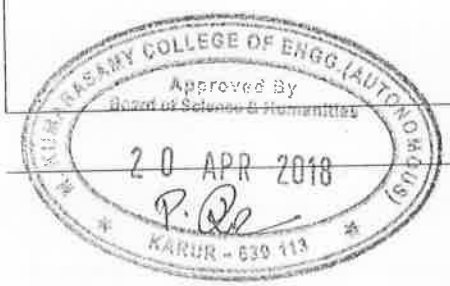
Introduction to Quantum mechanics-Explanation of wave nature of particles-Black body radiation-Compton effect-Solving Problems-Photoelectric effect-de Broglie hypothesis for matter waves - Physical Significance of wave function -Time independent Schrödinger's wave equation -Time dependent Schrödinger's wave equation -Solving Problems-Particle in a 1 D box -Normalization - Born interpretation of wave function -Properties of Matter waves-Verification of matter waves-G.P. Thomson Experiment-Solving Problems.

UNIT IV	WAVE OPTICS	9+3

Introduction to interference-Introduction to diffraction-Fresnel diffraction-Fraunhofer diffraction-Fraunhofer diffraction at single slit-Fraunhofer diffraction at double slit-Solving Problems-Fraunhofer diffraction at multiple slit-Diffraction grating-Characteristics of diffraction grating-Applications of diffraction grating-Polarization by reflection-Polarization by double refraction-Solving Problems -Scattering of light-Circular polarization-Elliptical polarization-Optical activity-Fresnel's relation -Brewster's angle--Solving Problems.

UNIT V	LASER AND FIBER OPTICS	9+3

Absorption and emission processes-two level-Einstein's theory of matter radiation A and B coefficients-Characteristics of laser beams-Amplification of light by population inversion-Threshold population inversion-Essential components of laser system and pumping mechanisms-Solving Problems-Nd: YAG laser-Semiconductor laser-CO_2laser Vibrational modes- CO_2 laser-energy level-Optical fiber-physical structure-Total internal reflection-Solving Problems-Numerical aperture - Acceptance angle-Losses associated with optical fibers-Classification of optical fibers-Optical fiber communications system-Optical sensors-Solving Problems.



LIST OF EXPERIMENTS	30

1. Basics of experimentation
2. Determine dielectric constant of the sample
3. Calibrate Ammeter using Potentiometer
4. Calibrate voltmeter using Potentiometer
5. Determine the energy loss of magnetic materials using B-H curve experiment
6. Determine Planck's Constant
7. Study of I-V characteristics of a light dependent resistor (LDR)
8. Determine wavelength of monochromatic light by Newton's ring
9. Determine particle size using laser
10. Determine wavelength of using diffraction grating
11. Determine wavelength for a given laser source
12. Study of numerical aperture and acceptance angle of optical fiber
13. Mini project

Text books/ References:

1	David Jeffery Griffiths, Introduction to Electrodynamics, Revised edition, Pearson, 2013
2	Ajay Ghatak, Optics, Tata McGraw Hill Education, 5th edition, 2012
3	David Halliday, Fundamentals of Physics, 7th edition, John Wiley & Sons Australia, Ltd, 2004
4	Berg and Resnick, Quantum Physics: Of Atoms, Molecules, Solids, Nuclei and Particles, 2nd Edition, 1985

Regulation 2018		Semester I / Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18CSS101J(R)	PROGRAMMING FOR PROBLEM SOLVING	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Learn programming using a structured programming language
CO2	Provide exposure on C programming.
CO3	Introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

Course Outcome (s) (COs):

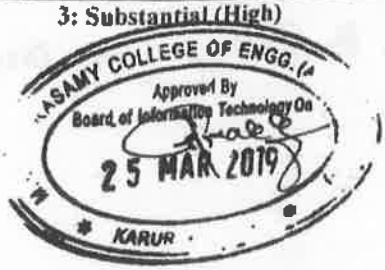
At the end of this course, learners will be able to:

CO1	Apply the problem solving techniques for solving numeric and string problems
CO2	Solve basic numeric problems using control statements in C
CO3	Develop the C program using the concepts of array and string.
CO4	Apply the concept of function prototypes and pointers.
CO5	Compare the performance of structures and union in memory management.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-
CO2	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-
CO3	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-
CO4	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-
CO5	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-
CO (Avg)	3	3	-	-	-	-	-	-	2	1	-	3	3	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



8.10 **Syllabus Revision for 18CSS101J Programming for Problem Solving**

- Faculties and Students felt that current syllabus is too heavy. Suggested for reframing the syllabus and accepted for reframing as 2 0 2[Total Credits:3].
- Basics need to be concentrated much through practicals.

MEMBERS PRESENT

1. Dr.A.Kannan - A. Kannan
2. Dr.G.Mohana Prabha - 25/3/19
3. Dr.R.Suganya - 25/3/19
4. Dr.T.Abirami - 25/3/19
5. Ms.Nivetha Ravichandran - R. Nivetha
6. Mr.S.N.Gowtham -
7. Dr.V.Durgadevi - 25/3/19
8. Mr.A.Shanmugavelaytham - A. 25/3/19
9. Mrs.R.Sujatha - R. 25/3/19.
10. Mr.M.Gunasekar - 25/3/19
11. Mr.E.Balraj - 20
12. Mr.S.Vinoth (15BIT2058) - 25/3/19
13. Mr.R.Balaji (16BIT3013) - R. Balaji 25/3/19

14. Ms. B. Sinthiya (OBE Coordinator) - B. 25/3/19

UNIT I	INTRODUCTION	6
Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems– Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.		
UNIT II	**C PROGRAMMING BASICS**	**6**
Structure of a 'C' program – Tokens – Data Types – Operators –Input and Output operations – Decision Making and Branching – Looping statements.		
UNIT III	**ARRAYS AND STRINGS**	**6**
Arrays: Declaration – Initialization – One dimensional and Two dimensional arrays – String: String Declaration and Initialization–String Functions.		
UNIT IV	**STRUCTURES AND POINTERS**	**8**
Introduction to Structures-Need for Structure Data type – Structure: Definition, Declaration – Structure vs Union. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays –Null Pointer – Pointer to Structures.		
UNIT V	**FUNCTIONS**	**4**
Function – Definition of function – Declaration of function – Function Prototype – Pass by value – Pass by reference.		
LIST OF EXPERIMENTS		**15**

1. Programs on Operators
2. Programs on Control statements
3. Programs on one Dimensional Array
4. Programs on Two Dimensional Array
5. Programs on String Handling
6. Programs on Function using Call by Value
7. Programs on Function using Call by Reference
8. Programs on Pointers
9. Programs on Structures
10. Programs on Union

Text Book (s)

1	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2	PradipDey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009

Reference (s)

1	Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2	Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3	Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
4	Yashavant P. Kanetkar, " Let Us C", BPB Publications, 2011.

Regulation 2018		Semester I / Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18CSS101J	PROGRAMMING FOR PROBLEM SOLVING	1	0	4	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	To learn programming using a structured programming language
CO2	To provide exposure on C programming.
CO3	To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

Course Outcome (s) (COs):

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

CO1	Apply the problem solving techniques for solving numeric and string problems
CO2	Solve basic numeric problems using control statements in C
CO3	Develop the C program using the concepts of array and string.
CO4	Apply the concept of function prototypes and pointers.
CO5	Compare the performance of structures and union in memory management.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	2	1	-	3	1	1
CO2	3	3	-	-	-	-	-	-	2	1	-	3	1	1
CO3	3	3	-	-	-	-	-	-	2	1	-	3	1	1
CO4	3	3	-	-	-	-	-	-	2	1	-	3	1	1
CO5	3	3	-	-	-	-	-	-	2	1	-	3	1	1
CO (Avg)	3	3	-	-	-	-	-	-	2	1	-	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO C	9

Evolution of Programming & Languages - Problem solving through programming - Creating algorithms - Drawing flowcharts - Writing pseudocode - Evolution of C language, its usage history - Input and output functions: Printf and scanf - Variables and identifiers - Expressions, Constants - Keyword ,Single line and multiline comments- Values, Names, Scope - Binding, Storage Classes - Input and Output Statement - Numeric Data types - Non-Numeric Data types: char string - Non-Numeric Data types: string - Increment operator - decrement operator - Comma, Arrow and Assignment operator - Sizeof operator - Bitwise operators - Relational Operators - logical Operators - Conditional Operators - Operator Precedence

UNIT II	CONTROL STATEMENT AND ARRAY	9

If statement in expression - L value and R value in expression - Control Statements – if and else – else if – nested if - switch case - Iterations – While loop - do..While loop - For loop - Goto, break, continue - Array Basic and Types - Array Initialization and Declaration - Initialization: one Dimensional Array, Accessing - Indexing one Dimensional Array Operations - Initializing and Accessing 2D Array - Initializing Multidimensional Array - Array Advantages and Limitations

UNIT III	STRINGS AND FUNCTIONS	9

String Basics - String Declaration and Initialization - String Functions: gets(), puts(), getchar() - putchar(), printf()atoi(),. strlen()strcat(), stremp()sprint(), sscanf()strcpy(), strstr()Strrev(), strtok()Functions basics - Functions declaration and definition - Types: Call by Value - Call by Reference - Function with Arguments and no Return Values - Function without Arguments and no Return Values - Function with Arguments and Return Values - Function without Arguments and Return Values - Passing Array to Functions - Returning array from functions - Formal and Actual Parameters - Recursion Functions - Advantages of using Functions

UNIT IV	POINTERS	9

Pointers Basics - Address operator - Pointer Declaration - dereferencing pointers - Size of Pointer Variable and Pointer Operator - Void Pointers and size of Void Pointers - Arithmetic Operations - Incrementing Pointers - Constant Pointers - Null Pointers - Pointers to array elements - Pointers to strings - Function Pointers

UNIT V	STRUCTURES AND UNIONS	9

Structure basics & declaration - Initializing Structure, Accessing members - Nested structure - Array of structure - Accessing elements in a structure array - Passing Array of structure to function - Union Basic and declaration - Accessing Union Members - file: opening, defining - File closing, File Modes, File Types - Writing contents into a file - Reading file contents - Appending an existing file - File permissions and rights - Changing permissions and rights

LIST OF EXPERIMENTS	15

1. Programs on Operators
2. Programs on Control statements

	3. Programs on one Dimensional Array 4. Programs on Two Dimensional Array 5. Programs on String Handling 6. Programs on Function using Call by Value 7. Programs on Function using Call by Reference 8. Programs on Function prototypes 9. Programs on Passing and returning Array to Functions 10. Programs on Recursion Functions 11. Programs on Pointers 12. Programs on Structure 13. Programs on Union 14. Programs on Files
Text Book (s)	
1	Zed A Shaw, Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C), Addison Wesley, 2015
2	Bharat Kinariwala, TepDobry, Programming in C, eBook
3	W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd ed. Prentice Hall, 1996

Regulation 2018		Semester I / II	Total 3ours			75
Category	Course Code	Course Name	3ours / Week			C
			L	T	P	
S	18MES102J	BASIC CIVIL AND MECHANICAL ENGINEERING (ECE)	3	0	2	4

Prerequisite Course (s)

Nil

Course Objective (s):

- Select building materials and identify the components of a building
- Identify the various transportation systems, bridges, dams and water supply system
- Apply the concept of Harnessing energy from various energy sources
- Know the working of IC engines and identify the sub system requirements
- Apply manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding

Course Outcome (s) (COs):

CO1	Identify the building materials and its applications
CO2	Identify different transportation system, water supply system and its applications
CO3	List the basic components and analyze the working of major power plants
CO4	Identify the working of IC engines and understand the need of various auxiliary systems
CO5	Identify manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	-	3	3	-	-	-	-	3	-	-
CO2	3	-	3	-	3	3	3	-	3	-	-	3	-	-
CO3	3	-	-	-	-	-	3	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3		3		3	3	3		3			3		

UNIT I	BUILDING MATERIALS	9

Introduction to Civil Engineering, Building Materials, History, Disciplines in Civil Engineering, Early constructions and development over time, Ancient Monuments: Peruvudaiyar or Brihadeeswarar Temple, Kallanai dam Grand Anicut, Taj Mahal, Golconda fort, Angkor Wat, Pyramids of Giza, Colosseum Development of various materials, Methods of Construction, Building Materials - Stone – Classification of Rocks, Quarrying, Dressing, Properties and Uses of Stone Mortar, Plain and Reinforced Cement, Concrete Grade and properties and uses, Necessity of Special Concrete, Self Compacting Concrete, Construction Chemicals (Plasticizers), Recycling: construction, demolition wastes, Buildings, Classification of Buildings, Selection of site for a building, Components of Buildings, Soil, General types of soil, Bearing Capacity, Factors affecting bearing capacity, Foundations: Functions, General types of, foundation, Shallow foundations

UNIT II	TRANSPORTATION AND WATER SYSTEM	9

Cement concrete flooring, Marble flooring, Granite flooring, Ceramic tile flooring, Roofs: Types of roofs, Madras terrace roof, Reinforced concrete roofs, Trussed roof, Roof Coverings: Types, Weathering course: Types, Mode of Transportation - Highways - Classification of Roads, Cross section details of flexible pavements, Railways – Zone and Headquarters, Permanent way and its requirement. Components of Permanent way, Bridges: Components of Bridge, Types, Dams: Purpose, Classification, Gravity dams - Advantages and Disadvantages, Elements of protected Water Supply system, Objective, Quantity of water, Design period, Per-capita demand, Factor affecting per capita demand, Sources of Water Supply, Standards of Drinking water, Drinking Water Treatment: Objectives, Treatment plant process, Sewage: Method of collection, Sewage treatment and disposal

UNIT III	POWER PLANTS	9

Coal based thermal Power Plant: layout, components description,working, advantages, disadvantages, Hydro Electric power plant: layout, components description, working, advantages and disadvantages, Nuclear power plant: Nuclear fission and fusion reactions, Nuclear reactor, components description, Layout, working, merits and demerits of boiling water reactor , Layout, working, merits and demerits of pressurized water reactor, Gas turbine power plants:componentsdescription,working and types gas turbines, methods to improve performance, Layout and working of open cycle plant with intercooling, reheating, regeneration, Solar Thermal power plant: layout of Flat plate collector based plant, central receiver type plant, advantages, disadvantages, Wind energy conversion system – wind turbine types, Working, advantages and disadvantages, Ocean Thermal Energy Conversion system: layout of open cycle , Layout of closed cycle, advantages, disadvantages

UNIT IV	INTERNAL COMBUSTION ENGINES	9

Engine: Classification,operations of 2 stroke & 4 stroke, Comparison of SI & CI engines, Fuel supply system and Battery ignition system, Magneto ignition system of SI engine, Working of a simple carburetor, GDI, MPFI, CRDI. Lubrication system of an engine, Functions and Working of mist and forced feed lubrication system, Cooling system of an engine – Working of air cooled (fins), Water cooled engines (forced circulation), Alternate fuels for IC Engines. Liquid fuels: methanol, ethanol, vegetable oil, Biodiesel, Gaseous fuel: Hydrogen, CNG, LPG, properties, advantages, disadvantages, Emissions from engine – Emission standards - Euro, BS. Emission control measures – Catalytic converter, Exhaust gas recirculation, Introduction to electric vehicles, Hybrid and autonomous vehicles

UNIT V	CASTING AND FORMING PROCESS	9

Casting introduction and history, Expandable mold casting process , Production steps in a typical sand-casting process, terms including patterns and core, Other expendable mold casting: shell molding, vacuum molding, expanded polystyrene process, Investment casting, Permanent mold casting: hot chamber and cold chamber die casting & Permanent moldcasting:Semi centrifugal and centrifuge casting. Metal forming introduction and its classification, metals and alloys, Bulk deformation: hot, cold forging processes, hot rolling processes,cold rolling processes, Rolling mill classification, hot and cold extrusion processes,

processes, Sheet metal working, applications. Cutting operations: shearing, blanking, punching, cutoff, parting, slotting, perforating, notching, trimming, shaving, fine blanking, Bending operations: V-bending, edge bending, flanging, hemming,seaming, curling, spring back effect, Drawing operations, its defects, coining, embossing, ironing, lancing, twisting	
Text Book (s)	
1	Dr.V.Rameshbabu,"Basic Civil and Mechanical Engineering", VRB Publishers pvt ltd, 2017
Reference (s)	
1	SeropeKalpakjian, Steven Schmid," Manufacturing Processes for Engineering Materials", Pearson, 2016
2	Drbal, Larry F. Boston, Patricia G. Westra, Kayla L. Black, Veatch, "Power Plant Engineering", Kluwer Academic Pub., 1995
3	Andy Walker, "Solar Energy", John Wiley & Sons, 2013
4	John B. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw Hill Education, 2017
5	Kumar. T, Leenusslesu Martin and Murali. G. "Basic Mechanical Engineering", Suma Publications, Chennai, 2007.

LIST OF EXPERIMENTS

Total: 30hours

1.	Study about Brick, Stone & Cement: Types, Uses, Structural steel, Timber properties and uses
2.	Study about Water Supply, Distribution System, Water Treatment Plant, Sewerage System
3.	Study about basics of Casting, processes, Equipment's. To make the mould using stepped flange
4.	Basics of Metal Arc welding operations, Equipment's, Tools, Butt joint of two metal plates using arc welding process
5.	Welding-Lap joint of two metal plates overlapping on one another using arc welding process.
6.	Basics of fitting practice, tools and method of producing models, Tools, Step fitting of two metal plates using fitting tools
7.	Half Round, Vee fitting of two metal plates using fitting tools
8.	Basics of Carpentry operations, Equipment's, Tools, Cross halving joint of two wooden pieces at perpendicular direction
9.	To make duster from wooden piece using carpentry tools.
10.	Basics of Sheet metal operations, Equipment's, Tools and demonstration of producing models, To make geometrical shape like frustum
11.	Sheet metal operations - To make geometrical shape like square tray, rectangulat tray
12.	Sheet metal operations - To make geometrical shape like Cone , Funnel
13.	Study the basics of moulding and processes, Equipment's, To make plastic models using injection moulding of simple part
14.	Basics of Plumbing practices for G.I and P.V.C., Tools and demonstration of producing models
15.	Plumbing of bathroom/ kitchen fittings using G.I. fittings, P.V.C. fittings

Regulation 2018		Semester I/Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH101L	PROFESSIONAL SKILLS AND PRACTICES	0	0	2	1

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Equip students with different aspects of Presentation
CLR-2	Train students to use appropriate language for publics peaking.
CLR-3	Help students better understand basic leadership qualities and personality traits
CLR-4	Train the students to face interview confidently.
CLR-5	Make students understand how setting goals in life is important.

Course Outcome (s) (COs):

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

CO1	Make presentation in a formal way.
CO2	Speak with clarity and confidence, thereby enhancing their employability skills.
CO3	Enable students to understand different aspects of leadership and evaluate in their own strengths.
CO4	Clear the job interview successfully.
CO5	Realize that selecting goal is a fundamental component to long- term success of an individual.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO3	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO4	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO5	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO(Avg)	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	PRESENTATIONS	5
Tips and Techniques for an Effective Presentation - Effective presentation structure - Types of Presentation - Verbal aspect of a presentation - Non-verbal aspect of a presentation – body language - Stress management during a presentation		
UNIT II	**PUBLIC SPEAKING**	**5**
Importance of Public Speech - Dealing with fear and Anxiety - Tips and Techniques for Public Speaking - Informative Speech - Delivering a Persuasive Speech - Dealing with audience questions		
UNIT III	**LEADERSHIP SKILLS**	**5**
Communication – Motivation – Delegating – Creativity – Responsibility - Commitment		
UNIT IV	**INTERVIEW SKILLS**	**5**
Preparing for a Job Interview - The Interview Process - Telephone Interviews - Interview Techniques - Mock Interview - Mock Interview		
UNIT V	**GOAL SETTING**	**5**
Types of goals - Reasons for goal setting - Goal Setting Process - S.M.A.R.T. goals - Tips and Techniques for Goal Setting - Trouble in Setting Goals		
LIST OF EXPERIMENTS		**5**
1. Make a presentation on a general topic 2. Give a persuasive speech 3. Exhibit your leadership qualities 4. Mock interview 5. Share your realistic short term and long term goals and the ways to attain them.		

Text Book (s)

	NIL

Reference(s)

1	Aruna Koneru, Professional Communication, Tata McGraw-Hill Publishing Company Limited, New Delhi
2	Professional Skills and Practice, Oxford University Press
3	https://www.skillsyouneed.com
4	https://www.Business English Site.com

Regulation 2018		Semester I	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM101T	CONSTITUTION OF INDIA	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Utilize the citizen's rights
CLR-2	Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy
CLR-3	Identify the Indian constitutional framework with union parliament, government and their functions and citizen's rights
CLR-4	Utilize the States functionality and provisions for the betterment of the individual and society
CLR-5	Identify the emergency provisions, the functions of election and public service commissions, identify the tax system

Course Outcome (s) (COs):

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

CO1	Identify the basic provisions in the Indian constitution
CO2	List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation
CO3	Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions
CO4	Identify the power of states, its legislature, Governors role and the state judiciary
CO5	List the special provisions and functionality of election commission, public service commission, individual tax and GST

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO4	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO5	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO (Avg)	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INDIAN CONSTITUTION	3
Meaning of the Constitution law and Constitutionalism- Historical perspective of the Constitution of India- Salient features and characteristics of the Constitution of India Citizenship- Scheme of the fundamental rights- Scheme of the Fundamental Duties and its legal status		
UNIT II	**FUNDAMENTAL RIGHTS**	**3**
The Directive Principles of State Policy- Scheme of the Fundamental Right to Equality- Scheme of the Fundamental Right to certain Freedom under Article 19- Scope of the Right to Life and Personal Liberty under Article 21- Union Government, Union Legislature (Parliament)- LokSabha and RajyaSabha (with Powers and Functions), Union Executive		
UNIT III	**POWERS AND FUNCTIONS OF CENTRAL GOVERNMENT**	**3**
President of India (with Powers and Functions)- Prime Minister of India (with Powers and Functions) - Union Judiciary (Supreme Court)- Jurisdiction of the Supreme Court - State Government, Legislature, Legislative Assembly, Legislative Council- Powers and Functions of the State Legislature, State Executive- Governor of the State (with Powers and Functions)		
UNIT IV	**POWERS AND FUNCTIONS OF STATE GOVERNMENT**	**3**
The Chief Minister of the State (with Powers and Functions)- State Judiciary (High Courts) Union Territory, Panchayat, Municipality- Scheduled and Tribal Areas- Co-operative Societies Consumer Rights - Consumer Protection Act		
UNIT V	**POWERS AND FUNCTIONS OF ELECTION AND SERVICE COMMISSION**	**3**
Local Self Government – Constitutional Scheme in India-Emergency Provisions : National, President Rule, Financial Emergency - Election Commission of India (with Powers and Functions) - The Union Public Service Commission (with Powers and Functions) - Amendment of the Constitutional Powers and Procedure -Income Tax, Goods and Services Tax		

Text Book (s)

	NIL

Reference (s)

1	DurgadasBasu, Introduction to the Constitution of India,Lexis- Nexis, 2015
2	Subash C Kashyap, Our Parliament, National Books Trust, 2011
3	Kaushal Kumar Agarwal, India's No 1 book on Tax : Simple Language Advanced Problems: Income Tax, Kindle, 2017
4	Vivek K R Agarwal, GST Guide for students: Making GST – Good and Simple Tax, Neelam Book House, 2017

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Regulation 2018		Semester I&II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18GNM101L	Physical and Mental Health using Yoga	0	0	2	0

Prerequisite Course (s) Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	provide deeper insight into the curriculum of Yogic Sciences along with the practical applications of Yoga
CLR-2	intend that students should get familiar with the poses of Yogasanam.
CLR-3	Promote positive health in the Student through Yoga and enabling and imparting skill in them to practice and apply Yogic
CLR-4	practice for Health to general public and teach Yoga for Total personality development and spiritual evolution.

Course Outcome (s) (Cos):

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

CO1	increase the muscle strength
CO2	improve respiration, energy and vitality.
CO3	maintain a balanced metabolism and weight reduction.
CO4	maintain cardio and circulatory health.
CO5	improve athletic performance and protection from injury.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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	Introduction:	6
	▪ Human Body- Meaning and its Importance in Yoga ▪ Definition of Anatomy and Physiology ▪ Cell: Structure & Function	
	General information, Different parts, Structure, Function and Effect of Yogic Practices.	24
	▪ Tissues: Types, Structure & Function. ▪ Musculo-Skeletal System ▪ Digestive system ▪ Excretory system ▪ Respiratory system ▪ Circulatory system ▪ Nervous System ▪ Endocrinal system	

Text / Reference (s) books:

1.	Shirley Telles - A Glimpse of the Human Body The structure anf Functions, Swami Vivekananda Yoga Prakashana, Bangalore.
2.	Makarand Madhukar Gore - Anatomy and Physiology of Yogic Practices, Motilal Banarsidass, New Delhi, 2007
3.	Anne Waugh, Allison Grant - Ross and Wilson Anatomy and Physiology in Health & Illness, Churchill Livingstone; 2010

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Regulation 2018		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	PROFESSIONAL ENGLISH	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Develop team spirit and stress management skill
CLR-2	Demonstrate the interpersonal skills of the learners
CLR-3	Make learners perform well in interviews
CLR-4	Enable them to listen well and express their ideas, opinions effectively in official contexts
CLR-5	Sharpen their reading comprehension skill
CLR-6	Strengthen their official written communication skill.

Course Outcome (s) (COs):

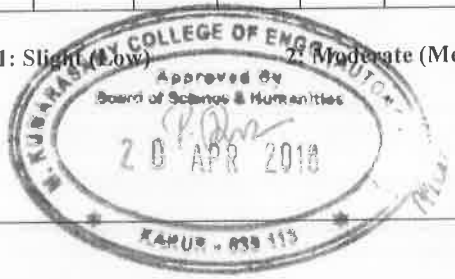
At the end of this course, learners will be able to:

CO1	Work in a team under any situation.
CO2	Practice interpersonal relationships in workplace
CO3	Face interviews confidently and successfully
CO4	Participate and excel in role plays, presentations and formal conversations.
CO5	Read and infer the meanings of technical and aesthetic passages.
CO6	Draft official letters, reports, memos, emails, etc.,

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO2	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO3	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO4	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO5	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO6	1	1	3	3	3	3	1	3	3	3	-	3	-	-	-
CO (Avg)	1	2.66	1.33	3	3	3	1	3	3	3	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	SOFT SKILLS	7
Introduction to Soft Skills(MCQ on Soft Skills)-Leadership Skills(Handling a Team) -Optimism & Business Etiquettes(Presentations on How to Handle Situations Effectively)-Team Management (Motivational Videos on Positive Thinking)- Time Management(Discussion on Real Time Hardships) -StressManagement(Handling Criticism)-Organizational Communication - Channels of Communication(Case Study).		
UNIT II	**LISTENING**	**7**
Listening Skills: Active Listening, Passive Listening(Classroom Listening Activities)-Methods for improving Listening Skills, Listening and its process – Barriers to Listening(Innovative Practices and Strategies for Better Listening) – Listening to Pre-Recorded video/audio (Listening to Famous Motivational Speeches)- Listening to Reading in the Class - for Vocabulary - for Complete Understanding – for Better Pronunciation(Read aloud a Story or an Article to Listen and Complete the Task) - Listening for General Content – Listening to fill up Information(Listening –fill in the Form Activity) – Intensive Listening for Specific Purpose-Listening to Monologues(Listening to Announcements) -Extensive Listening(Listening to Business News).		
UNIT III	**SPEAKING**	**5**
Defining Presentation and its Purpose; Audience & Local; Organizing Contents; Preparing Outline(Mini presentation)- Audio-Visual Aids; Nuances of Delivery; Body Language;(PPT Presentation) - Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice(Voice Modulation Practice)-Interviews &Its Types-Role Play(Mock Interview) -Group Discussion-Oral Presentations -Formal Conversations(Group Discussion Practice) .		
UNIT IV	**READING**	**5**
Reading & Its Types- Techniques for Good Comprehension, Reading Comprehension(Reading Comprehension Exercises) - Cloze Test ,Reading Newspaper- Editorials & Business Articles (Cloze Test Exercises)- Inferring Meaning- Improving Comprehension Skills(Reading for Meaning) - Skimming and Scanning– Structure of the Text – Structure of Paragraphs(Skimming and Scanning Exercises) - Interpreting Visual Communication(Graphs, Charts, Tables)(Interpreting the Graphical images).		
UNIT V	**WRITING**	**5**
Writing Official Letters(Invitation Letter (Accepting & Declining),Quotation, Ordering, Complaining, Seeking Clarification)(Business Letter Writing Exercises), Writing Official Letters(Permission – In-Plant Training)- Writing CV (Job Application)(Job Application Letter Exercise)- Essay Writing-Email Writing - Writing Reports & Proposal(Writing a Business Report)- Writing Circulars, Memos, Agenda & Minutes(Exercises on Writing Circulars, Memos, Agenda & Minutes).		
	LIST OF EXPERIMENTS	**16**
1. Videos on Stress Management (Stress Management Activities) 2. Videos on Team Spirit (Team Activities) 3. Listening to TED Talks(Listening to Business Interviews) 4. Listening to Business Presentation (Listening to Business Interviews) 5. Telephonic Conversation (Organizing a Meeting) 6. Product Launch (Persuasive Speech) 7. Business Conversations 8. Business Role Play Activities 9. Reading for Pleasure(Intensive Reading) 10. Extensive Reading(Briefing Favourite Self Help Books)		

11. Reading Newspaper articles(Reading Business Reports) 12. Reading Business Legends Success Formula(Read Between the Lines) 13. Writing an Advertisement (Writing Slogans for Products) 14. Error Correction Exercises (Formal Language expressions) 15. Business Vocabulary (Writing Official E-mails) 16. Writing Business Proposals (Writing Permission Letters)	
Text Book (s)	
1	Abirami K, "Professional English", First Edition, R.K.Publishers, Coimbatore, 2019.
Reference (s)	
1	LinaMuhkopadhyay, et al., "English for Jobseekers" ,Cambridge University Press, New Delhi,2013
2	Brook Hart Guy , Business Benchmark Advanced Personal Study Book for BEC and BULATS, Cambridge
3	Mascull , Bill, Business Vocabulary in Use, Third Edition, Nov 2017
4	Emerson Paul, Business English Handbook ,Advanced, Macmillan
5	www.Business English Site.com
6	www.businessenglishpod.com

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Regulation 2018		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB102T	ADVANCED CALCULUS AND COMPLEX ANALYSIS	3	1	0	4

Prerequisite Course (s)

Calculus and Linear Algebra

Course Objective (s):

The purpose of learning this course is to:

1	Evaluate Double and triple Integral and apply them in problems in Engineering Industries
2	Evaluate Surface, Volume Integral and applications of Gauss theorem, Stoke's and Green's theorem in Engineering fields
3	To know the properties of Complex functions and apply them in all the Engineering fields
4	Evaluate improper integrals involving complex functions using Residue theorem and apply them in Engineering fields
5	Transform engineering problems into ODE, PDE and Integrals and solve them using Laplace / complex analytic methods

Course Outcome (s) (Cos):

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

CO1	Evaluate multiple integrals using change of variables
CO2	Apply techniques of vector calculus in problems involving Science and Engineering.
CO3	Apply complex analytic functions and its properties in solving problems
CO4	Evaluate improper integrals using Residue theorem involving problems in Science and Engineering
CO5	Apply techniques of Laplace Transforms and inverse transform for problems in Science and Engineering and Solving Ordinary Differential Equations

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	3	-	-	3	-	-	-
CO2	3	-	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	3	-	-	3	-	-	-
CO4	-	3	3	-	-	-	-	-	3	-	-	3	-	-	-
CO5	-	3	-	-	-	-	-	-	3	-	-	3	-	-	-
CO (Avg)	3	3	3	3	3	-	-	-	3	-	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	MULTIPLE INTEGRALS	9 + 3
Evaluation of double integration in cartesian and polar Coordinates - Evaluation of double integral by changing of order of integration - Area as a double integral (Cartesian and Polar) - Conversion from Cartesian to Polar in double integrals - Triple integration in Cartesian Coordinates - Volume as triple integral in Cartesian, Polar and Spherical Coordinates.		
UNIT II	**VECTOR CALCULUS**	**9 + 3**
Gradient,Divergence,Curl,Solenoidal,Irrotational fields - Directional derivative - Line integrals - Surface integrals - Volume Integrals - Green's theorem (excluding proof) :Applications in evaluating Line and Region - Gauss divergence theorem (excluding proof):Applications to cubes and parallelopipeds - Stoke's theorem (excluding proof):Applications to cubes and parallelopipeds.		
UNIT III	**ANALYTIC FUNCTION**	**9 + 3**
Definition of Analytic function – Cauchy Riemann equations- Properties of Analytic function - Determination of Analytic function using Milne's Thomson method-Conformal mapping (w=c+z, w=cz, w= $\frac{1}{z}$) - Bilinear transformation.		
UNIT IV	**COMPLEX INTEGRATION**	**9 + 3**
Cauchy's integral theorems (without proof) - Cauchy's integral formulae - Taylor's expansions with simple problems - Laurent's expansions with simple problems - Singularities - Poles and their types - Residues - Cauchy's residue theorem (without proof)- Contour integration: unit circle and semicircle.		
UNIT V	**LAPLACE TRANSFORMS**	**9 + 3**
Laplace Transforms of standard functions- Transforms properties- Transform of derivatives and integrals - Initial & Final value theorems (without proof) and Verification for some problems- Inverse laplace transforms using Partial fractions and Shifting theorem- Convolution theorem- Periodic functions- Solution of linear second order ODE equations with constant coefficients.		

Text Book (s)

1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

Reference (s)

1	B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008
3	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
4	G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002

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Regulation 2018		Semester I /Semester II	Total Hours			90
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18CYB101J	CHEMISTRY	3	1	2	5

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- Apply the basic principles of chemistry at both atomic and molecular levels in understanding the concepts related to the engineering field.
- Integrate the chemical principles in their projects undertaken in their respective fields
- Enhance the quality of a materials used in the product from the technological aspects for societal applications

Course Outcome (s) (Cos):

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

CO1	Identify the suitable polymeric materials fabrication processes in various application
CO2	Apply the basic principle of inorganic chemistry at the atomic and molecular levels
CO3	Apply the various thermodynamic and kinetics concepts to real system
CO4	Assemble a battery through the understanding of electrochemical principles
CO5	Catagorize the Engineering materials for their applications

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	3.00	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENGINEERING ORGANIC MATERIALS	9*+3*

Polymer – Introduction- classification(based on molecular weight, structure and usage)- types of polymerization(Addition, Condensation and Copolymerisation)-crystallinity, melting point and glass transition temperature-mechnism of polymerization(free radical addition polymerization)-elastomer- structure and curing(vulcanization)- Fabrication and molding of polymers(Injection molding and blow molding)- Engineering plastics – PE, PVC, PMMA, Phenol formaldehyde resin , urea formaldehyde resin(Preparation, properties and uses)- Industrial applications of polymers.

UNIT II	COORDINATION AND ORGANOMETALLIC COMPOUNDS	9*+3*

Co-ordination compounds – Introduction- nomenclature- types of ligands (mono, di and poly dendate ligands)- isomerism(structural and stereo isomerism) – theories of bonding(Werner and Sidgwick Pouvell theory(EAN rule)) – applications – EDTA titration – Organometallic compounds - synthesis(organo zinc, organo Lithium and Organo magnesium) – Applications (18 electron rule, Ziegler Natta Catalyst and Hydroformylation)

UNIT III	THERMODYNAMICS AND KINETICS	9*+3*

Introduction- first and second law of thermodynamics – Gibbs –Helmholtz equation – Clausius clapeyron equation – Maxwell relations – Vant hoff isotherm and Isochore (problems also)- Kinetics- Introduction- types of reactions(opposing, consecutive and parallel reactions)- chain reactions (HBr and HCl formation)- Applications of kinetics and thermodynamics.

UNIT IV	ENGINEERING ELECTROCHEMISTRY	9*+3*

Introduction- Conductors and its types - cells (Electrolytic and Electrochemical cells) – Standard electrode potential- Nernst equation of an electrode- types of electrodes (SHE and Calomal electrode)- Batteries –Types (Primary, Secondary, Flow and reserve battery)- Examples (Lead acid battery, Ni-Cd battery, Lithium battery, Lithium sulphur battery and Hydrogen- Oxygen fuel cells)- Graphene.

UNIT V	INDUSTRIAL APPLICATIONS OF CHEMISTRY	9*+3*

Cement (Types, manufacture and properties) – Paints (constitutions and functions)- Lubricants- types- mechanism – properties-abrasives – types –Diamond, Corundum, emery, garnet, quartz, Silicon carbide, carborundum-boron carbide, alundum (preparation, properties and uses) –applications – Basics of biosensor and biochips.

LIST OF EXPERIMENTS	30

1. Determination of total , permanent and temporary hardness of water sample (EDTA method)
2. Determination of alkalinity in water sample- Indicator method
3. Determination of chloride content of water sample by Argentometric method(Mohr's method)
4. Determination of dissolved oxygen content of water sample by winkler's method
5. Conductometric titration of strong acid with strong base
6. Conductometric titration of mixture of acids

7. Determination of strength and amount of Hydrochloric acid- pH metry 8. Estimation of strength and amount of ferrous ion by potentiometric method 9. Determination of molecular weight of a polymer by viscometry method 10. Estimation of ferrous ion by colorimetry. 11. Cement analysis

Text / Reference (s) books:	
1	B.L.Tembe, Kamaluddin and M.S.Krishnan , "Engineering chemistry"
2	S.S. Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd, New Delhi (2009).
3	P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., NewDelhi (2012).
4	Shashi Chawla, Engineering Chemistry: Dhanpat Rai &Co., 3rd Edition, 2015
5	www.nptel.ac.in

Regulation 2018		Semester I /Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18MES101J	**ENGINEERING GRAPHICS** (ELECTRONICS AND COMMUNICATION)	1	0	4	3

Course Objective (s):

1. Construct ellipse, Parabola, hyperbola, cycloid and involutes.
2. Sketch the projection of points, straight lines and plane surfaces.
3. Sketch the Projection of simple solids like prisms, pyramids, cylinder and cone
4. Sketch the sectional solids and developing the lateral surfaces of simple solids
5. Understand the three dimensional drawing of simple solid by isometric projection and perspective projection, and convert isometric projection to orthographic projection.

Course Outcome (s) (COs):

CO1	Apply engineering graphic fundamentals to draw/evaluate engineering curves.
CO2	Draw the graphics of engineering parts with point, line and plane projections
CO3	Draw projection of solid objects like prisms, cylinders, pyramids and cones used in engineering objects
CO4	Develop the lateral surfaces of the sectional solids.
CO5	Create 3D part models using isometric and perspective projection.

CO-PO Mapping

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PS O3
CO1	3	2	2	2	2	-	2	3	2	2	-	3	1	-	-
CO2	3	2	3	2	2	-	1	2	3	2	-	3	2	1	-
CO3	3	2	3	2	3	-	1	2	3	2	-	2	2	1	-
CO4	3	2	3	2	3	-	1	2	3	2	-	2	1	-	-
CO5	3	2	2	2	2	-	1	2	2	2	-	3	1	-	-
CO (Avg)	3	2	2.6	2	2.4	-	1.2	2.2	2.6	2	-	2.6	1.4	1	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	PLANE CURVES	9
Principles of Engineering Graphics - Lettering - dimensioning - Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes – Drawing of tangents and normal to the above curves.		
UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**	**9**
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations. Projection of polygonal surface and circular lamina inclined to both reference planes.		
UNIT III	**PROJECTION OF SOLIDS**	**9**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.		
UNIT IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES**	**9**
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.		
UNIT V	**ISOMETRIC PERSPECTIVE AND ORTHOGRAPHICS PROJECTIONS**	**9**
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method. Isometric to orthographic multi-view.		

Text Book (s)

1	K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2010).
2	K. Venugopal& V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 15th edition (2018).

Reference (s)

1	1. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications, 2010.
2	2. R. L Jhala "Engineering Graphics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2015.
3	3. DhananjayA.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, 2008.
4	4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.
5	5. M.S. Kumar, "Engineering Graphics", D.D. Publications, 2009.

List of Expertiments.

1	Spiral and involutes using bspline or cubic spline
2	Plan of residential building
3	Simple steel truss
4	Isometric projection of simple objects
5	Creation of 3D model
6	Orthographic projection of given 3D object
7	Projection of planes with inclination to reference plane
8	Solids with inclination to one reference plane
9	Section view of simple solids
10	Development of solids

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06 FEB 2018
KARUR - 639 113

Regulation 2018		Semester - I / Semester - II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18EES101J(R)	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Gain the knowledge about D.C and A.C circuits.
2	Impart the fundamentals of electrical machines.
3	Study the fundamentals of semiconductor devices
4	Study the working concepts of measuring instruments.
5	Know about digital logic concepts and operational amplifier.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Apply the concepts of ohm's law and Kirchhoff's law in DC and AC circuits
CO2	Explain the basic concepts of DC motor, DC generator, Transformer and Induction motor.
CO3	Summarize the nature of semiconductor devices.
CO4	Interpret the concept of measuring devices like PMMC, MI, energy meter and wattmeter.
CO5	Infer the concept of electronics devices and conversion techniques

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	1	1	-	1	3	1	1
CO2	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO3	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO4	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO5	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO (Avg)	3	2	1	1	1	-	-	-	1	1	-	1	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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DATE 15/10/2020

BOS - 9

SEU – unit 1 title may be solar radiation and measurements
PQ – IEEE Standards to be included in unit 2, 3 and 4.

OPen electives.

IOT – No change
FSM – Interchange the unit 3 & unit 4
Robotics – No change.
ESD & FC – No change.
EV – Course name may be changed as fundamentals of electric vehicles
IOT and ESD & FC subjects can be included in professional electives for EEE students with different name.

BEEE – The subject content in all the 5 units are revised based on the feedback from the stack holders
One credit course – Board is accepted to conduct three one Credit courses from 5th Semester onwards for this 2018 regulation

BTech (CSBS) – Principles of electrical engineering Course content also discussed and Verified.

PG 2019 Regulation.

Power System Protection Course may be added as elective course in third Semester
electronics
Analog and digital electronics Subject Codes are revised

15/10/2020

UNIT I	ELECTRICAL CIRCUITS	9

Electrical quantities: Resistors, Inductors, Capacitors - Ohm's Law - Kirchoff's Laws -Series and Parallel circuits - Analysis of DC circuits: Mesh & Nodal analysis, Thevenin's Theorem, Norton's Theorem & Maximum Power Transfer Theorem, Star delta Transformation, RL & RC Transient Analysis. Introduction to AC Circuits: Waveforms and RMS Value – Power and Power factor- Introduction to three phase systems – Types of connections, Relationship between line and phase values.

UNIT II	ELECTRICAL MACHINES	9

Faraday's laws- Construction, Principle of Operation, Basic Equations of DC Generators, DC Motors – Two Point & Three Point Starter – Construction, Working and EMF Equation of Single Phase Transformer – Construction and Working of AC Generator – Three Phase Induction Motor: Construction and Working of Squirrel Cage and Slip Ring Induction Motor – Single Phase Induction Motor (Split Phase, Capacitor Start Induction Motor).

UNIT III	ELECTRONIC DEVICES	9

Intrinsic and Extrinsic Semiconductors – PN junction diode , Zener diode and its Characteristics – Operation of Half Wave, Full Wave and Bridge Type Rectifiers – Bipolar Junction Transistor: Configurations and Characteristics of CB, CE, CC – Construction and Operation of JFET, MOSFET.

UNIT IV	MEASUREMENTS	9

Basic Principles and Classification of Instruments – Construction and Working of PMMC, MI Instruments (Attraction & Repulsion type) – Principle of Operation of Dynamometer Type Wattmeter, Induction Type Energy Meter – Instrument transformer – CRO – Megger.

UNIT V	DIGITAL & INTEGRATED CIRCUITS	9

Number Systems – Boolean Theorems– Logic Gates – Half Adder and Full Adder Circuit – Flip-Flops: RS, JK, T and D – A/D Converter (Successive Approximation Type) – D/A Converter (Binary Weighted Type) – Op-Amp : Functional Block and Types (Inverting , Non-Inverting & Differential Amplifier).

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LIST OF EXPERIMENTS	15

1. Verification of Ohm's & Kirchoff's Laws
2. Types of Wiring (Fluorescent Lamp & Staircase)
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Characteristics of PN Junction Diode
6. Characteristics of Common Base Configuration.
7. Characteristics of Common Emitter Configuration.
8. Measurement of Ripple Factor: Half Wave & Full Wave Rectifier.
9. Study of AC and DC Machines
10. Verification of Logic Gates
11. Study of PMMC and MI Meters

Text Book (s)	
1	R. Muthusubramanian, S. Salivahanan,"Basic Electrical and Electronics Engineering," Tata McGraw-Hill, 2012
2	Sawhney, A.K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2011.
Reference (s)	
1	Dash.S.S, Subramani.C, Vijayakumar.K, "Basic Electrical Engineering", Vijay Nicole, 1st Edition, 2013.
2	Jegatheesan.R, "Analysis of Electric Circuits", Tata McGraw-Hill, 2014.
3	Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning Private Ltd, 2nd Edition, 2010.

Regulation 2018		Semester I/ Semester II	Total Hours			90
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18EES101J	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	2	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Analyze given electric circuits consisting of active and passive components.
2	Identify the parts, functions and working of motors, generators and transformers that function in AC and DC.
3	Utilize the basic electronic devices and circuits.
4	Utilize the working concept of measuring instruments.
5	Build simple logical circuits using Boolean expressions. Identify elements in Integrated circuit.

Course Outcome (s) (COs):

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

CO1	Discuss basic theory utilized in electrical circuits and its circuits.
CO2	Describing working principle of direct current and alternative current machines such as transformers, motors and generators.
CO3	Operate the basic electronic devices. Identify their uses and construction features.
CO4	Interpret the concept of measuring devices like PMMC, MI ,energy and wattmeter.
CO5	Apply binary logic and Boolean expressions for digital circuit design, Identify elements in a Integrated circuit.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	2	2	2	2	-	2	-	-	-
CO2	3	2	1	1	2	-	2	2	2	2	-	2	-	-	-
CO3	3	-	1	1	2	-	2	2	2	2	-	2	-	-	-
CO4	3	-	1	1	1	-	2	2	2	2	-	2	-	-	-
CO5	3	2	2	2	2	-	2	2	2	2	-	2	-	-	-
CO (Avg)	3	2	1.2	1.2	1.8	-	2	2	2	2	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ELECTRICAL CIRCUITS	12

Introduction to DC and AC circuits, Active and Passive two terminal elements, Ohms law,Voltage-Current relation, Power, Energy, R,L,C Circuits, Voltage and Current Sources, Kirchoff's current law, Kirchoff's voltage law, Problem Solving Session, Mesh Current Analysis, Nodal Voltage Analysis, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Star- Delta Transformation, Problem Solving Session, Resistive Circuit Analysis, Superposition, Convolution, RL Circuit Transient Analysis, RC & RLC Transient Analysis , Three Phase Systems, Star and delta Connections, Relation between Line and, Phase, Problem Solving Session.

UNIT II	DC MACHINES & AC MACHINES	12

Sinusoids, Generation of AC, Average, RMS values, Form and peak factors, Analysis of single phase AC circuit, Real, Reactive, Apparent power, Power factor, Magnetic materials, B-H Characteristics Simple magnetic circuits, Faraday's laws, induced emf and inductances. 1 - Phase transformers: Construction, types, ideal, practical transformer, EMF equation, Regulation, Efficiency, Problem Solving Session, Construction, working of DC Generators, Types of DC generators, Characteristics of Generators, Applications of DC generator, Working and types of DC motors, Characteristics , Two point starter and Three point starter, Problem Solving Session, AC generators (Alternators), Construction, working, Characteristics of Alternators, Losses, Single Phase motors: Split phase induction motor & Capacitor start induction motor, Working and types of single phase AC motors, Squirrel Cage and Slip ring induction motor, Types of AC starters (Autotransformer, star-delta and Rotor resistance starter), Problem Solving Session.

UNIT III	ELECTRONIC DEVICES	12

Overview of semiconductors, Intrinsic and Extrinsic semiconductors, Operation of PN Junction diode , Characteristics of PN Diode, Operation of Zener diode, Characteristics of Zener Diode, Overview of diode circuits, Operation of Half-wave rectifier, Half wave : Ripple factor Expression, Advantages, Disadvantages, Operation of Full-wave rectifier, Full wave : Ripple factor Expression, Advantages, Disadvantages, Bridge type rectifier operation, Comparison of rectifier circuits, Overview of filters and its uses, BJT construction, operation, BJT characteristics (CB, CE and CC configurations) and uses, JFET construction, operation, JFET characteristics (Drain and Transfer characteristics), Depletion mode and Enhancement mode MOSFET construction operation, MOSFET characteristics (Transfer and output characteristics), Problem Solving Session.

UNIT IV	MEASUREMENTS	12

Methods of measurements – Overview, Types of Measurements: Primary, Secondary, Tertiary, Basic principles and Classification of Instruments- Indicating, Recording and Integrating, Construction and working of PMMC, PMMC-Torque Equation, Advantages, Disadvantages, Construction and working of MI Instruments, MI (Attraction type)-Operation, MI Attraction type-Advantages , Disadvantages, MI (Repulsion type)- Operation, Torque Equation, MI (Repulsion type)- Errors, Advantages, Disadvantages, Overview of Instrument Transformers, Current Transformer, Potential Transformer, CRO, CRT, Operation of Dynamometer type watt meter, Advantages and Disadvantages, Operation of Induction type watt meter, Advantages and Disadvantages, Megger –Construction, Working, Measurement of Earth resistance

UNIT V	DIGITAL AND INTEGRATED DEVICES	12

Number systems, binary codes, Binary arithmetic, Boolean algebra, laws and theorems, Simplification of Boolean expression, Logic Gates and Operations, Simplification of Boolean expression, Problem Solving Session, SOP and POS Expressions, Standard forms of Boolean expression, Simplify using Boolean Expressions, Minterm and Maxterm, K-Map Simple Reduction Technique, Two, Three and Four Variable K-Map, Problem Solving Session, Half adder circuit, Full adder circuit, Flip-flops : RS , JK, T and D Flip-flops, A/D Converter-Successive Approximation , D/A Converter-Binary Weighted, Overview of Op-Amp, Op-Amp : Functional block & Types (Inverting, Non-inverting & differential amplifier).

LIST OF EXPERIMENTS	30

1. Verification of Kirchoff's Law
2. Verification of all Theorems,
3. Time Domain Analysis (RL, RC).

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4. Types of wiring (Flourescent lamp,Staircase ,godown wiring).
5. Demo of DC Machine & Parts
6. Demo of AC Machine & Parts.
7. Characteristics of semiconductors
8. Measurement of Ripple factor (Half-wave and Full-wave).
9. Characteristics of CB and CE configurations
10. Demo of PMMC and MI Meters.
11. Waveform verification using CRO.
12. Measurement of Energy using Single phase Energy meter.
13. Verification of Boolean expression using logic gates.
14. Reduction using Digital Logic Gates.
15. Design and test of Inverting and Non-Inverting Amplifier using IC741

Text Book (s)

1	R. Muthusubramanian, S. Salivahanan."Basic Electrical and Electronics Engineering, Tata McGraw-Hill, 2012

Reference (s)

1	Dash.S.S. Subramani.C. Vijayakumar.K, Basic Electrical Engineering, 1st ed.,Vijay Nicole, 2013.
2	Jegatheesan.R,Analysis of Electric Circuits, Tata McGraw-Hill; 2014.
3	P. S.Bimbhra ,Electrical Machinery,7th ed,. Khanna Publishers, 2011.
4	Moris M. Mano, Digital Design, 3rd ed.,Pearson, 2011.
5	Sawhney A.K., A Course in Electrical & Electronic measurements and Instrumentation,Dhanpat Rai and Co,2011.

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Regulation 2018		Semester I/ Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH102L	GENERAL APTITUDE	0	0	2	1

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR1	Recapitulate fundamental mathematical concepts and skills
CLR2	Hone critical thinking skills by analyzing the arguments with explicit and implicit premises
CLR3	Sharpen logical reasoning through skillful conceptualization
CLR4	Identify the relationships between words based on their function, usage and characteristics
CLR5	Nurture passion for enriching vocabulary
CLR6	Acquire the right knowledge, skill and aptitude to face any competitive examination.

Course Outcome (s) (COs):

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

CO1	Build a strong base in the fundamental mathematical concepts
CO2	Identify the approaches and strategies to solve problems with speed and accuracy
CO3	Gain appropriate skills to succeed in preliminary selection process for recruitment
CO4	Collectively solve problems in teams and groups
CO5	Build vocabulary through methodical approaches
CO6	Enhance lexical skills through systematic application of concepts and careful analysis of style, syntax, semantics and logic

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO2	-	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO3	-	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO4	1	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO5	-	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO6	-	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO (Avg)	1	3	-	3	2	-	-	-	3	3	1	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I		**6**
Types of numbers, Divisibility tests -Introduction to Significance of Verbal Aptitude in Competitive Examinations - LCM and GCD -Vocabulary enrichment techniques - Unit digit, Number of zeroes, Factorial notation - Vocabulary enrichment Techniques.		
UNIT II		**6**
Square root, Cube roots, Remainder - Identities - Contextual Vocabulary Exercise - Synonyms Fractions and Decimals, surds -Contextual Vocabulary Exercise -Antonyms		
UNIT III		**6**
Percentage Introduction - Sentence Completion Basic Level Exercises : Single Blank - Percentage Problems - Sentence Completion Basic Level Exercises : Double Blank - Profit and Loss - Cloze Test		
UNIT IV		**6**
Discount -Reading Comprehension – Introduction -Simple Interest - Reading Comprehension – Summary & Main Idea - Compound Interest, Installments - Reading Comprehension – Summary & Main Idea		
UNIT V		**6**
Logarithms Intro - Grammar Rules :A comprehensive Introduction - Logarithms Rules - Sentence Completion – Grammar - Linear Equations - Spotting Errors		

Text Book (s)

1	Nil

Reference (s)

1	Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random House Reference, 2002
2	Merriam Webster's Vocabulary Builder, Merriam Webster Mass Market, 2010
3	Norman Lewis, How to Read Better and Faster, Goyal, 4th Edition
4	Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014
5	Wiley's GMAT Reading Comprehension Grail, Wiley, 2016
6	Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition
7	Martin Hewings, Advanced Grammar in Use. Cambridge University Press, 2013
8	Nishit K. Sinha, The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT
9	Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations

Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM102T	VALUE EDUCATION	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Connect the learners to their potential, identify their potential to create a new positive world
CLR-2	Analyze the merits and demerits of different educational systems. Identify the different systems of education
CLR-3	Draw attention towards the weaknesses they are susceptible to and inspire them through positive models
CLR-4	Instill a sense of professional ethics which help them develop a safe comfortable and prosperous society
CLR-5	Cultivate a spirit of willing accommodation in an increasingly diverse world

Course Outcome (s) (COs):

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

CO1	Equipped with an awareness of their positive energy and power
CO2	Identify the meaning of 'education'; have a clearer and better understanding in taking education to the masses
CO3	Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances
CO4	Realize their professional responsibilities
CO5	Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	2	3	-	3	3	3	-	3	-	-	-
CO2	2	3	2	-	3	3	2	2	3	3	-	3	-	-	-
CO3	2	-	-	-	2	3	2	2	3	3	-	3	-	-	-
CO4	3	2	-	-	3	3	3	3	3	3	-	3	-	-	-
CO5	2	-	-	-	3	3	3	3	3	3	-	3	-	-	-
CO (Avg)	2	2.33	2	-	2.6	3	2.5	2.6	3	3	-	3	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	VISIONS FOR YOUTH	6
Introduction (Quiz) - Two speeches by great personalities (Oral presentations) - Quotes, proverbs relating to the power and potential of youth, Excerpts: Wings of Fire (Collecting proverbs highlighting the potential of youth) - Two news articles highlighting the initiatives for social causes by youth (Role play in a similar context) - One song exhibiting the positive energy of youth (Discussion on the song)		
UNIT II	**YOUTH AND EDUCATION**	**6**
Meaning and the significance of education (Brainstorming) - Overview of different (traditional, modern) educational systems (Debate) - Role of youth in education, Urban and Rural set up, dissemination (Student presentations) - Designing and framing educational curriculum and materials (Students' Presentation based on write ups) -The pressing challenges in current educational system (Collage Design)		
UNIT III	**YOUTH AND SOCIETY**	**6**
Need for social values in the present context (Poem – "Where the mind is without fear" , Write up on various instances from real life) - Individual and group behaviour, respect for others (Case study on recent happenings) - Civic sense, bullying-substance abuse, uses of expletives (Case study on recent happenings) - Hero worship, gender insensitivity moral policing (Case study on recent happenings) - Positive contribution by youth in promoting social welfare (Short videos followed by discussions)		
UNIT IV	**YOUTH AS PROFESSIONALS**	**6**
Introduction to professional values (Brainstorming through visual cues) - Engineering societies in India (Quiz) - Challenges to be addressed by Engineers in India (Case Study) - Challenges in different sectors: agriculture (Case Study) - Challenges in different sectors: urban development, environment (Group activity (oral and written)) - Challenges in different sectors: sustainable development, cyber security (Case Study – from Newspapers)		
UNIT V	**YOUTH IN PLURALISTIC SOCIETY**	**6**
Introduction to pluralistic society, forces of globalization (Group Discussion) - Science and technology intercultural proximity (Narration of stories from various religions to illustrate the oneness of humanity) - Positive, Negative impact: religion, politics, gender, economic status, aesthetics (Discussion on "To Kill a Mocking Bird") - Values required to live in a global society (Poster presentation on festivals of various religions) - Learning the etiquettes of various societies (Poster presentation on festivals of various religions) - Success of pluralistic society, enliven the society, religious harmony through literary (Writing the aspects of pluralistic society based on the text).		

Text Book (s)

	Nil

Reference (s)

1	Kalam, APJ Abdul. Wings of Fire: AN Autobiography of APJ Abdul Kalam. Ed. Sangam Books Ltd., 1999
2	"Banaras Hindu University Speech" and "To Students". The Voice of Truth. General Editor Shriman Narayan. Navajivan Publishing House. pp. 3-13 and pp. 425-30. www.mkgandhi.org
3	Piroda, Sam. "Challenges in Science and Technology". www.nfdindia.org/loc19.htm

4	Thomas A Address to VTU Students by Narayana Murthy. https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/
5	World Economic forum. "India's top 7 challenges from skills to water scarcity"

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Regulation 2018		Semester III	Total Hours			60
			Hours / Week			
Category	Course Code	Course Name	L	T	P	C
B	18MAB202T	PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA (B.E ECE)	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Introduce the Fourier series and its applications to the solution of partial differential equations.
2	Understand how to solve linear partial differential equations using different methods
3	Give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject
4	Introduce the basic notions of groups, rings, fields which will then be used to solve related problems
5	Provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.

Course Outcome (s) (Cos):

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

CO1	Familiarize the students with the concept of Fourier series.
CO2	Apply partial derivative equation techniques to predict the behaviour of certain phenomena.
CO3	Solve various types of partial differential equations and apply the acquired knowledge in signals and Systems, Digital Signal Processing. etc
CO4	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO5	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomena.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	2	1	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	2	1	-
CO5	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	2.8	3	1.8	2.5	-	-	-	-	-	-	-	-	2.25	1.25	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	FOURIER SERIES	9 + 3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series — Parseval's identity – Harmonic Analysis.		
UNIT II	**PARTIAL DIFFERENTIAL EQUATIONS**	**9 + 3**
Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second order with constant coefficients.		
UNIT III	**BOUNDARY VALUE PROBLEMS**	**9 + 3**
Classification of second order partial differential equations-Solutions of one dimensional wave equation – One dimensional equation of heat conduction –Solution of two dimensional heat Equation in cartesian coordinates.		
UNIT IV	**VECTOR AND LINEAR SPACE**	**9 + 3**
Introduction to vector space and sub space - linear independent and dependent - spanning set - basis and dimension - row space and column space.		
UNIT V	**BASICS OF PROBABILITY AND RANDOM VARIABLE**	**9 + 3**
Sample spaces and events – counting – probability - the axioms of probability - some elementary theorems - conditional probability - total probability - Baye's theorem (only statement) - Random variable - Probability mass function - Probability density functions- Properties.		

Text Book (s)	
1	Grewal.B.S, Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2012.
2	Steven.J.Leon-"Linear Algebra with Application", Prentice Hall of India Pvt.Ltd, New Delhi, 8th edition, 2010.
3	S.C.Gupta, V.K.Kapoor, " Fundamentals of Mathematical Statistics", Eighth Edition, Sultan Chand and Sons, New Delhi, 2001
Reference (s)	
1	Veerarajan.T, "Engineering Mathematics", 3rd Edition. , Tata McGraw Hill, New Delhi, 2004.
2	Kreyszig.E., "Advanced Engineering Mathematics", John Wiley and Sons,(Asia)Pte Ltd., Singapore.2006.
3	Gilbert Strang , "Introduction to Linear Algebra", 4th edition Wellesley- Cambridge Press, 2009.

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Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18ECS201J	DIGITAL ELECTRONICS	3	0	2	4

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to

1.	Simplify Boolean expressions using basic postulates of Boolean algebra.
2.	Synthesize the basic combinational circuits
3.	Synthesize the basic Sequential circuits
4.	Synthesize combinational and sequential logic using programmable logic devices.
5.	Synthesize the synchronous& asynchronous sequential circuits.

Course Outcome (s) (COs): At end of this course, the learners should be able to

CO1	Analyze the Boolean functions and Boolean Expressions
CO2	Analyze the combinational circuits
CO3	Analyze the sequential networks.
CO4	Analyze the characteristics and structure of different memory systems and programmable logic devices.
CO5	Analyze digital circuits by using hardware description languages.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	3	-	-	3	3	2
CO2	3	3	3	-	2	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	2	-	-	-	3	-	-	3	3	2
CO5	3	2	2	-	2	-	-	-	-	-	-	3	2	2
CO (Avg)	**3**	**2.6**	**2.6**	**2**	**2**	-	-	-	**3**	-	-	**3**	**2.8**	**2**

1:Slight (Low) **2:Moderate (Medium)** **3: Substantial (High)**

UNIT I	MINIMIZATION TECHNIQUES	9

Minimization Technique: Boolean postulates and laws –De–Morgan's Theorem –Minimization of Boolean expressions using Boolean laws and theorem –Standard Form, Canonical Form, –Sum of Products (SOP) –Product of Sums (POS) – Don't care conditions –Minimization of Boolean expressions up to 4 variables using Karnaugh map and Quine Mc Cluskey method.

UNIT II	COMBINATIONAL CIRCUITS	9

Design procedure: Half adder / subtractor –Full Adder / subtractor –Parallel binary adder/Subtractor –Carry Look Ahead adder –BCD adder-Multiplexer/ Demultiplexer–Decoder –Encoder–Parity generators -Parity checker –Code converters(BCD to Excess3 , BCD to Gray) –Magnitude Comparator.

UNIT III	SEQUENTIAL CIRCUITS	9

Latches, Flip flops –SR, D,JK, T and Master –Slave –Characteristic table and Equation –Application table –Edge and level Triggering –Realization of one flip flop using other flip flops –Serial Adder/Subtractor –Asynchronous Ripple counter –Synchronous counters (Up/Down counters)–Design of Synchronous counters –modulo n counter –Ring counter -Shift registers –Universal shift registers.

UNIT IV	MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES	9

Classification of memories –ROM, PROM, EPROM, EEPROM, EAPROM, RAM-Static RAM Cell–Dynamic RAM cell, Programmable Logic Devices –Programmable Logic Array (PLA) –Programmable Array Logic (PAL)–Field Programmable Gate Arrays (FPGA) –Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT V	SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS	9

Synchronous Sequential Circuits: General Model –Classification –Analysis of Synchronous Sequential Circuits - Asynchronous Sequential Circuits: Design of fundamental mode circuits –races and hazards –Design of Hazard Free Switching circuits –Preface to VHDL programming Design of Combinational circuits using VHDL.

LIST OF EXPERIMENTS	15

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of code converters for BCD to Excess-3 conversion and Excess-3 to Conversion
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MS devices.
4. Design and implementation of 2-bit and 8-bit magnitude comparator using MS devices.
5. Design and implementation of multiplexers and demultiplexers.
6. Design and testing of flip-flops using gates.
7. Implementation of SISO, SIPO, PISO and PIPO shift registers using flip-flops.
8. Implementation of any combinational circuit design using FPGA.

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9.Write VHDL coding for Combinational Circuits	
Text Book(s)	
1	M.Morris Mano and Michael D. Ciletti, "Digital Design: 5th Edition, Pearson Education Pvt. Ltd.,2012
2	S.Salivahanan and S.Arivazhagan, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Pvt. Ltd, 2012
Reference (s)	
1	S K Mandal "Digital electronics" MC Graw Hill Education Private Limited, New Delhi , First Reprint 2016.
2	John F.Wakerly, "Digital Design: Principles and Practices", 4th Edition, Pearson/PHI, 2005.
3	John.MY arbrough, "Digital Logic Applications and Design", Thomson Learning, 1996
4	Douglas L Perry "VHDL:Programming by examples" Fourth Edition,Mc Graw-Hill publication,

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC201T	ELECTROMAGNETIC FIELDS	3	0	0	3

Prerequisite Course (s)

Advanced Calculus and Complex Analysis

Course Objective (s): The purpose of learning this course is to

1	Analyze fields and potentials due to static charges
2	Evaluate static magnetic fields
3	Understand how materials, affect electric and magnetic fields

Course Outcome (s) (COs): At end of this course, the learners should be able to

CO1	Summarize various coordinate systems
CO2	Calculate the Electric Flux density due to various charge distributions.
CO3	Describe Magnetic Flux density due to various current distributions.
CO4	Explain various boundary conditions for electric and magnetic fields.
CO5	Discuss Maxwells equations and electromagnetic waves

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	1	-	3	-	-	3	3	2
CO2	3	-	-	-	-	-	2	-	-	-	-	3	2	2
CO3	3	2	2	2	-	-	2	-	3	-	-	3	3	2
CO4	2	2	-	-	-	-	1	-	-	-	-	3	2	2
CO5	2	-	-	-	-	-	2	-	-	-	-	3	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	2.6	2.3	2	2	-	-	1.6	-	3	-	-	3	2.4	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO COORDINATE SYSTEM	9

Definition of scalar, vector, dot and cross product- Problems in Curl, Divergence and Gradient – Introduction to Co-ordinate System–Rectangular-Cylindrical and spherical Coordinate System-Problems in Stokes theorem and Divergence theorem. Types of Integrals, Coulomb's Law in Vector Form–Principle of Superposition theorem.

UNIT II	STATIC ELECTRIC FIELD	9

Definition of Electric field Intensity-Electric field due to continuous charge distribution: Electric Field due to charges distributed uniformly on an infinite and finite line –Electric Field on the axis of a uniformly charged circular disc. Electric Scalar Potential and Electric Flux Density –Relationship between potential and electric field – Potential due to infinite uniformly charged line –Potential due to electrical dipole –Gauss Law –proof of Gauss Law -Applications.

UNIT III	STATIC MAGNETIC FIELD	9

Introduction to magnetic fields and its properties -The Biot-Savart Law in vector form –Magnetic Field intensity due to a finite and infinite wire carrying a current I –Magnetic field intensity on the axis of a circular loop carrying a current I –Ampere's circuital law – Proof of Ampere's circuital law- Applications. The Lorentz force equation for a moving charge – Definition of: Torque -Magnetic moment –Magnetic scalar potential- Magnetic Vector Potential

UNIT IV	ELECTRIC AND MAGNETIC FIELDS IN MATERIALS	9

Nature of dielectric materials-Electric Polarization–Boundary conditions for electric fields-Definition of Capacitance-Poisson's and Laplace's equation-Capacitance of Coaxial capacitor using Laplace's equation– Electrostatic energy and energy density–Electric current –Current density–point form of ohm's law–continuity equation for current.
Nature of magnetic materials –magnetization and permeability -magnetic boundary conditions-Definition of Inductance –Inductance of loops and solenoids –Definition of Mutual inductance. Energy density in magnetic field

UNIT V	ELECTROMAGNETIC WAVES USING MAXEWELL EQUATIONS	9

Maxwell's equation derived from Ampere's circuital law, Faraday's law, Electric and Magnetic Gauss's law. Definition of Poynting vector. Linear, Elliptical and circular polarization –normal incidence.

Text Book (s)

1	David K.Cheng "Field and Wave Electromagnetics"- Second Edition - Pearson Edition, 2004.
2	Matthew N.O.Sadiku "Elements of Engineering Electromagnetics" Oxford University Press, 4th edition, 2007.

Reference (s)	
1	Narayana Rao, N "Elements of Engineering Electromagnetics" 6th edition,Pearson Education, New Delhi, 2006.
2	G.S.N. Raju "Electromagnetic Field Theory & Transmission Lines" Pearson Education, 2006.
3	Ramo, Whinnery and Van Duzer "Fields and Waves in Communications Electronics" John Wiley & Sons, 3rd edition 2003.
4	William H.Hayt & John A Buck "Engineering Electromagnetics" TATA McGraw-Hill, seventh Edition 2007 .
5	E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems"Pearson Education/PHI 4nd edition 2006.

Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC202J	ANALOG ELECTRONICS	3	0	2	4

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Understand the Special semiconductor devices and Working methods of biasing of transistors.
2	Know technique for Midband analysis of amplifier circuits using small signal equivalent circuit.
3	Acquire knowledge on the method of calculating cutoff frequencies and to determine bandwidth.
4	Understand the high frequency analysis of amplifier circuits.
5	Study the design of power amplifiers and its characteristics.

Course Outcome (s) (COs): At end of this course, the learners should be able to

CO1	Review the stability factors of various biasing techniques used in BJT and FET.
CO2	Compute the hybrid model for different amplifiers.
CO3	Manipulate the high frequency analysis of single and multi-stage amplifiers.
CO4	Describe the hybrid model-π for different amplifiers.
CO5	Discuss the distortion and performance of different categories large signal amplifiers.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	1	-	3	2	-	3	3	2
CO2	3	3	2	-	-	1	1	-	-	2	-	3	3	2
CO3	3	3	2	-	-	-	-	-	-	2	-	3	3	2
CO4	3	3	2	-	-	-	-	-	3	2	-	3	3	2
CO5	3	3	2	-	-	1	1	-	3	2	-	3	3	2
CO (Avg)	3	3	2	-	-	1	1	-	3	2	-	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	TRANSISTOR BIAS STABILTY	9

BJT: Biasing, Q-Point, Variation of Q-Point, Stability factor. **Bias stability Concepts**: Fixed bias & collector to base bias of BJT - Voltage Divider bias of BJT - Source or self-bias of FET amplifier. **Bias Compensation:** Diode compensation - Thermistor & Sensistor compensation.

UNIT II	MIDBAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS	9

Analysis of a Transistor amplifier using h-parameter model - Comparison of Transistor Amplifier Configurations - Simplified Calculation of CE model - Simplified Calculation of CB model - Small signal model of FET Amplifier: CS, CD - Comparison of BJT and FET model - **Methods of increasing input impedance**: Bootstrapping circuit - Darlington Circuit.

UNIT III	FREQUENCY RESPONSE OF AMPLIFIERS	9

Differential amplifier: Introduction - Emitter coupled differential amplifier circuit - Bisection theorem - Differential gain - CMRR - Use of constant current circuit to improve CMRR. **Multistage amplifier**: Different coupling schemes – Need for cascading - General expression for frequency response of multistage amplifiers - Calculation of overall upper and lower cutoff frequencies of multistage amplifiers - Amplifier rise time and sag and their relation to cutoff frequencies.

UNIT IV	HIGH FREQUENCY ANALYSIS OF AMPLIFIERS	9

General shape of frequency response of amplifiers - Effect of emitter bypass capacitor on low frequency response - Hybrid pi CE Transistor model - CE Short circuit Current gain obtained with the hybrid pi model - Current gain with resistive load - Emitter follower at High Frequencies – CS, CD amplifiers at High Frequencies - Gain Bandwidth Product.

UNIT V	LARGE SIGNAL AMPLIFIERS	9

Classification of Large signal amplifiers: Series fed Class A amplifier - Transformer-coupled Class A amplifier - Efficiency of Class A amplifiers - Second harmonic distortion, higher order harmonic distortion - Class B amplifier efficiency - push-pull amplifier - complementary-symmetry amplifier - Class AB Amplifier - Class C power Amplifier - MOSFET power amplifier - Thermal stability and heat sink - Distortions in power amplifier.

LIST OF EXPERIMENTS	15

1. Design and construct Fixed Bias amplifier circuit using BJT
2. Design and construct BJT Common Emitter Amplifier using voltage divider bias(self-bias)
3. Darlington Amplifier using BJT
4. Source follower with Bootstrapped gate resistance
5. Differential amplifier using BJT

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6. Common Source Amplifier
7. Common Drain Amplifier
8. Class A Power Amplifier
9. Class B Complementary Symmetry Power amplifier
10. Class C tuned Amplifier

Text Book (s)	
1	Millman J and Halkias.C. Integrated Electronics, TMH, 2007.
2	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd, 2012
Reference (s)	
1	Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
2	David A. Bell, Electronic Devices & Circuits, 4th Edition, PHI, 2007
3	B.Rashid M, Microelectronics Circuits, Thomson Learning, 2007.
4	B.P. Singh and Rekha Singh, Electronic Devices and Integrated Circuits, Pearson Education, 2006.

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC203T	MEASUREMENTS AND INSTRUMENTATION	3	0	0	3

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1.	Understand general instrument system, error, calibration etc.
2.	Know the various operating principle of instruments which use to AC and DC measurements
3.	Elaborate discussion about storage & display devices
4.	Impart knowledge on various bridges.
5.	Create an exposure for various transducers.

Course Outcome (s) (COs): At end of this course, the learners should be able to

CO1	Analyze the performance characteristics of an instrument, standards and calibration.
CO2	Understand DC and AC measuring instruments.
CO3	Discriminate the functions of various storage and display devices.
CO4	Measure the R, L, and C using bridges.
CO5	Measure electrical and non-electrical quantities by transducers.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	3	-	-	-	1	-	-	-	-	-	2	1
CO3	3	2	3	-	-	-	1	-	-	-	-	-	2	1
CO4	3	2	3	-	1	-	1	-	-	-	-	-	2	1
CO5	3	3	3	-	-	1	-	-	-	-	-	-	2	1
CO (Avg)	3	2.4	2.8	-	1	1	1	-	-	-	-	-	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	BASICS OF MEASUREMENTS AND INSTRUMENTS	9

Functional elements of an instrument – static and dynamic characteristics - errors in measurements – statistical evaluation of measurement data - direct and indirect measurement methods - classification of instruments – standards and calibration.

UNIT II	ANALOG METERS	9

Analog ammeters and voltmeters: Permanent Magnet Moving Coil instrument (PMMC), Moving Iron instruments, electro dynamic instruments - Instrument transformer: current transformer, potential transformer – measurement of power – Electro dynamo meter type – frequency meters – synchroscope.

UNIT III	DIGITAL METERS AND STORAGE, DISPLAY DEVICES	9

Digital voltmeters - digital frequency meter – printers and plotters - cathode ray oscilloscopes – CRT circuits and screens - electrostatic deflection - digital storage oscilloscope - digital LED, LCD and dot matrix display.

UNIT IV	BRIDGES	9

Measurement of resistance – Wheatstone bridge, Kelvin's bridge - Measurement of self-inductance – Maxwell, Hay's, Owen's bridges – measurement of capacitance – Schering bridge - Frequency measurement using wien bridge.

UNIT V	TRANSDUCERS	9

Classification of transducers – selection of transducers – resistive transducers – strain gauge, bounded, unbounded and semiconductor gauges, resistance thermo meters, thermistors - inductive transducers – LVDT, RVDT- capacitive transducers – piezoelectric transducers - digital transducers.

Text Book (s)

1	Sawhney, A.K., A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, 2014.
2.	Albert D.Helfrick., William D.Cooper, Modern Electronic Instrumentation & measurement techniques, Prentice Hall of India 2003.

Reference (s)

1	Kalsi, H.S., Electronic Instrumentation, Tata McGraw Hill, 2012.
2	Doebelin, E.O., Measurement Systems – Application and Design, Tata McGraw Hill publishing company, 2005.
3	R.K Rajput, Electrical Measurements and Measuring Instruments, S.Chand & Company LTD, 2009

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC204T	NETWORK ANALYSIS AND SYNTHESIS	3	0	0	3

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to

1	Understand the basic knowledge in the analysis of transient circuits
2	Learn about network topology, filters and elements of network synthesis

Course Outcome (s) (COs): At end of this course, the learners should be able to

CO1	Analyze the transient response of circuits
CO2	Construct various network topologies
CO3	Solve one port and two port networks
CO4	Analyze different types of filters
CO5	Develop the RL, RC and LC networks

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	-	-	-	1	1	1	3	2
CO2	3	3	3	-	-	1	-	-	3	1	1	1	3	-
CO3	3	3	3	2	-	1	-	-	-	1	1	1	3	2
CO4	3	3	3	-	-	1	-	-	3	1	1	1	3	-
CO5	3	3	3	-	-	1	-	-	-	1	1	1	3	2
CO (Avg)	3	3	2.8	2	-	1	-	-	3	1	1	1	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	CIRCUIT TRANSIENT ANALYSIS	9
Transient Response of RL & RC series dc circuits using Laplace Transform - Transient Response of RLC series dc circuits using Laplace Transform method - Network Functions -Driving Point Functions and Transfer Functions- Poles and Zero's (Driving Point & Transfer Functions) - Graphical method for determination of Residue.		
UNIT II	**NETWORK TOPOLOGY**	**9**
Introduction - Graph of a network - trees, co trees and loops - Incidence matrix - Loop matrix - Cut set matrix -KVL - KCL - Network equilibrium equations		
UNIT III	**ONE PORT AND TWO PORT NETWORKS**	**9**
Driving point impedance and admittance of one port networks - Z parameters - Y parameters – ABCD parameters - h parameters - Inter relationship between parameters.		
UNIT IV	**FILTERS**	**9**
Characteristics of filters – Constant k Low pass filter – Constant k High pass filter – m Derived Low pass filter – m Derived High pass filter.		
UNIT V	**ELEMENTS OF NETWORK SYNTHESIS**	**9**
Introduction - Hurwitz polynomials -PR functions - Necessary and sufficient conditions of PR function – Synthesis of RL, RC and LC functions (Cauer and Foster forms)		

Text Book (s)	
1	Ravish R.Singh, "Network Analysis and Synthesis", McGrawHIII Education (India) Pvt.ltd, 4th edition, Reprint 2016.
2	ShyamMohan S.P., Sudhakar A, "Circuits and Network Analysis &Synthesis", Tata McGraw Hill, 5 th edition, 2015
Reference (s)	
1	M.E. Van Valkenburg., "Networks Analysis ", Prentice Hall of India, 2005
2	Franklin.F Kuo,' Network Analysis and Synthesis', Wiley International Edition, Second Edition, 1996.
3	Soni M.L and Gupta J.C, "Electrical circuit Analysis", Dhanpat Rai and Sons, Delhi, 1990.
4	UmeshSinha, "Network Analysis and Synthesis", SatyaPrakashan, 2010.
5	FrankelinKuo, "Network analysis & Synthesis", McGrawHill, 2010

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Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM201L	COMPETENCIES IN SOCIAL SKILLS	0	0	2	1

Course Objective (s):
The purpose of learning this course is to:

1	Sharpen problem solving skill and to improve thinking capability of the students
2	Hone soft skill and analytical ability of students
3	Engage learners in using language purposefully and cooperatively
4	Expertise the writing and presentation skill to fulfill the corporate expectations

Course Outcome (s) (Cos):
At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in an effective manner
CO2	Design and deliver information in a proper manner
CO3	Improve their presentation skills individually as well as a team member

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	2	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Coding & Decoding - Direction Sense Test. **Communication:** Self-Introduction and SWOT analysis - Letter writing - types.		
UNIT II	Module - 2	6
Aptitude: Venn Diagrams - **Data Interpretation.** **Communication: Phrasal verbs - Voice of Valluvar.**		
UNIT III	Module - 3	6
Aptitude: Averages. **Communication: Idioms and Phrases - Skits.**		
UNIT IV	Module - 4	6
Aptitude: Time and Distance - Problems on Trains. **Communication: Prefix/Suffix - Root words - Adjectives - JAM (Extempore Speech).**		
UNIT V	Module - 5	6
Aptitude: Clocks & Calendars. **Communication:** Homophones - **Frame Tales.**		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, **"A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015**

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Regulation 2018		Semester III / Semester IV	Total Hours			60
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18CYM201T	Environmental Science	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- To demonstrate in-depth knowledge within environmental engineering and an awareness of social, economic, political, and environmental impacts of engineering practices.
- To have competence for working with multi-disciplinary teams to arrive at solutions to environmental engineering problems.
- To get solutions which will minimize the negative impact of human activities on the environment and to protect human health

Course Outcome (s) (Cos):

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

CO1	Improve fundamental knowledge of the inter-relationships between the built environment and natural systems
CO2	Characterize and mitigate man-made hazards like nuclear hazards. Understand the principles involved in the generation of different forms of energy
CO3	Improve the reliability, performance, disaster-management of natural calamities and solid waste and water supplies and treatment processes.
CO4	Understand the source, effects and control measure of various environmental pollution
CO5	Apply information technology in the control of human population and women and child welfare

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	2	-	-	-	3	3	-	-	-	-	-	-	-
CO3	-	2	-	2	-	3	3	-	-	-	-	-	-	-
CO4	-	2	-	-	-	3	3	2	-	-	-	-	-	-
CO5	-	2	-	2	-	3	3	-	-	-	-	-	-	-
CO (Avg)	-	2.00	-	2.00	-	3.00	3.00	2.00	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ENVIRONMENT& BIODIVERSITY	3
Definition-types of environment, components of environment, scope-importance of environmental studies- Bio diversity-definition-value of biodiversity-Threats to biodiversity - India a mega diversity nation-endangered and endemic species of India-conservation of biodiversity.		
UNIT II	ENERGY SOURCES	3
Energy resources- Growing energy needs- Renewable and Nonrenewable energy sources- Use of alternate energy sources - Nuclear Energy- Alternative energy fuels-power alcohol-Bio diesel (preparation, properties &uses)		
UNIT III	SOCIAL ISSUES AND ENVIRONMENT	3
Environment ethics – Climate change – Global warming – Acid rain – Ozone layer depletion –Nuclear accidents-holocaust. Solid waste management - Rain water Harvesting-watershed management-		
UNIT IV	ENVIRONMENTAL POLLUTION & ACTs	3
Source, types, effects & control- Air pollution -Water pollution – Soil pollution – Marine pollution and Plastic Pollution -The Environment (Protection) Act - Air (Prevention and control of pollution) Act - Water (Prevention and control of pollution) Act- Role of individual in prevention of pollution.		
UNIT V	HUMAN POPULATION AND ENVIRONMENT	3
Sustainable development – Urban Population growth and distribution – Population explosion – Family Welfare Program –Women and child welfare- Role of information technology in environment and human health- case studies		

Text / Reference (s) books:

1	Dr.J.P.Sharma, " Environmental studies" , Laxmi Publications(p) Ltd, New Delhi.
2	Miller "Environmental Science" 11th Edition, Cengage Learning India Private Limited, New Delhi, (2006).
3	Master. G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt Ltd., (2004)
4	Dr.A.Ravikrishnan " Environmental Science and Engineering " Sri Krishna publications, Chennai(2015)
5	P.Anandan, R.Kumaravelan "Environmental Science and Engineering" Scitech Publication (India) Pvt. Ltd, Chennai, Reprint 2009.

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB205T	PROBABILITY THEORY AND RANDOM PROCESSES (B.E ECE)	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Study random variables and random processes as they apply in engineering disciplines.
2	Develop an understanding of discrete and continuous random variables and how they can be used to model and analyze systems.
3	Study probability density functions and cumulative distribution functions, and how they can be used to characterize engineering systems.
4	Understand test of hypothesis and how they relate to engineering applications and spectral densities.

Course Outcome (s) (COs):

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

CO1	Identify and Analyze the given data by using standard distributions.
CO2	Illustrate and apply the concept of pairs of random variables from the knowledge of sampling distributions.
CO3	Learners will understand the problems of Students T test for single mean and difference of means.
CO4	Study random processes, auto correlation and cross correlation applicable in the field of electronics and communication engineering.
CO5	Understand and analyze the problems associated with engineering applications.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	-	-	-	-	-	-	-	3	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	3	2	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	3	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-	3	3	-
CO (Avg)	2.4	2.4	1.4	1	-	-	-	-	-	-	-	-	2.8	2.4	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	RANDOM VARIABLE AND STANDARD DISTRIBUTIONS	9+3
Random variable - Moments - Moment generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions and their properties.		
UNIT II	**TWO DIMENSIONAL RANDOM VARIABLES**	**9+3**
Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem.		
UNIT III	**TESTING OF HYPOTHESIS**	**9+3**
Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes.		
UNIT IV	**CLASSIFICATION OF RANDOM PROCESSES**	**9+3**
Definition and examples - first order, second order, strictly stationary, wide - sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.		
UNIT V	**CORRELATION AND SPECTRAL DENSITIES**	**9+3**
Auto correlation - Cross correlation - Properties - Power spectral density - Cross spectral density - Properties - Wiener-Khintchine relation - Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function -Linear systems with random inputs - Auto correlation and Cross correlation functions of input and output.		

Text Book (s)

1	Oliver Ibe, "Fundamentals of Applied Probability and Random Processes" 2nd Edition, Elsevier, 2014
2	Scott Miller., Probability and Random Processes With Applications to Signal Processing and Communications, 2nd Edition, Texas A & M University, Academic Press, 2012.
3	R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th edition, 2007.

Reference (s)

1	Ross, S., "A First Course in Probability", Fifth edition, Pearson Education, Delhi, 2002.
2	Henry Stark and John W. Woods "Probability and Random Processes with Applications to Signal Processing", Pearson Education, Third edition, Delhi, 2002.

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Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18ITS201J	Data Structures and Object Oriented Programming	3	0	2	4

Prerequisite Course (s)

Programming for problem solving

Course Objective (s):

The purpose of learning this course is to:

1	Understand the basics of various Abstract Data Types with its operations.
2	Understand the data structures and algorithms for trees and graphs.
3	Explain about sorting algorithm, implementation and design of algorithms.
4	Summarize the basics of OOPs, declaration and definition of classes and objects.
5	Illustrate the concept of Inheritance, Polymorphism and Exceptions.

Course Outcome (s) (COs):

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

CO1	Describe various operation on the Abstract Data types
CO2	Discuss about the various operations performed in tree and graph data structures
CO3	Explain about various sorting methods and algorithm design techniques
CO4	Understand the concept of basics of OOPs , classes and objects
CO5	Explain inheritance, polymorphism and handling of exceptions

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	3	-	-	1	1	1	-	-	2	1
CO2	3	3	-	2	3	-	-	1	1	1	-	-	2	1
CO3	3	3	-	3	3	-	-	3	3	3	-	-	2	1
CO4	3	3	-	2	3	-	-	1	1	1	-	-	2	1
CO5	3	3	-	3	3	-	-	1	1	1	-	-	2	1
CO (Avg)	3	3	-	2.4	3	-	-	1.4	1.4	1.4	-	-	2	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	LINEAR DATA STRUCTURES	9
Algorithm Analysis - List, Stack and Queue - Priority queues - Binary Heap – Hashing - Hash table with/without linked list.		
UNIT II	NON LINEAR DATA STRUCTURES	9
Tree Traversal - Binary trees - Search tree ADT - AVL trees - Graph Algorithms - Shortest path algorithm (Single Source) - Minimum spanning tree		
UNIT III	SORTING AND ALGORITHM DESIGN	9
Sorting - Insertion sort - Shell sort - Heap sort - Merge sort - Quick sort - Indirect sorting - Bucket Sort - Introduction to Algorithm Design Techniques – Greedy algorithm (Minimum Spanning Tree) - Dynamic Programming (All pairs Shortest Path Problem).		
UNIT IV	CLASS AND OBJECTS	9
Introduction – Tokens – Expressions - Control Structures - Functions in C++ - Classes and Objects- Constructors and Destructors - Operator Overloading		
UNIT V	INHERITENCE AND POLYMORPHISM	9
Inheritance - Extending Classes – Pointers - Virtual functions and Polymorphism – Templates - Exception handling		
	LIST OF EXPERIMENTS	15

1. Implementation of List ADT
2. Implementation of Stack ADT
3. Implementation of Queue ADT
4. Tree Traversal
5. Binary Search Tree
6. Any 2 Sorting Techniques
7. Class and Objects
8. Function Overloading
9. Operator Overloading
10. Inheritance
11. Abstract Class & Constructor

Text Book (s)

1	Deitel and Deitel, "C++, How To Program", Fifth Edition, Pearson Education, 2005.
2	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third Edition, Addison Wesley, 2007

Reference (s)	
1	Bhushan Trivedi, "Programming with ANSI C++, A Step-By-Step approach", Oxford University Press, 2010
2	Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7th Edition, Wiley. 2004.
3	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, Mc Graw Hill, 2002
4	Bjarne Stroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2007
5	Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications, 2007.

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC205J	ANALOG INTEGRATED CIRCUITS	3	0	2	4

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Identify the working concept of Feedback amplifiers.
2	Understand the various Tuned amplifier and Multivibrators circuits
3	Study the basic principles, configurations and practical limitations of op-amp.
4	Understand the operation of timer, PLL, basic D/A and A/D converter types.
5	Understand the special functions if IC's.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Summarize the concept of Feedback amplifiers.
CO2	Review the concepts of Wave shaping circuits and tuned amplifier.
CO3	Illustrate the op-amp's basic construction, characteristics, parameter limitations, various configurations and few applications of op-amp.
CO4	Analyze the timer circuits, PLL and Analog to digital and Digital to Analog Convertors.
CO5	Analyze the special functions of IC's.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	3	2	1	-	3	2
CO2	3	2	1	1	-	-	-	-	3	2	1	-	3	2
CO3	3	2	1		-	-	-	-	2	2	1	-	3	2
CO4	3	3	2	2	2	-	-	-	3	2	1	3	3	2
CO5	3	3	2	2	2	1	1	-	3	2	2	3	3	2
CO (Avg)	3	2.4	1.4	1.6	2	1	1	-	2.8	2	1.2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	FEEDBACK AMPLIFIERS	9

Classification of basic amplifiers- Block diagram and transfer gain with and without feedback-Effects of negative feedback on Input and output Resistance-Classification of Oscillator- Condition for Oscillation-Analysis of LC oscillators: Hartley, Colpitt's-RC oscillators: Phase shift oscillator - Miller and Pierce Crystal oscillators.

UNIT II	TUNED AMPLIFIERS AND BLOCKING OSCILLATORS	9

Introduction - Analysis of capacitor coupled Single tuned amplifier- Effect of cascading single tuned on bandwidth - Stagger tuned amplifiers - Neutralization methods. Diode Clippers, Clampers - Blocking Oscillator: Astable Blocking Oscillators with base timing and Emitter timing - Time base circuits: Voltage-Time base circuit.

UNIT III	OP-AMP AND ITS APPLICATIONS	9

Basic Operational Amplifier - Characteristics of Op-Amp - Functional Block Diagram - Open and Closed loop configuration- DC characteristics and AC characteristics - Widlar Current Source – Wilson Current Source. Instrumentation amplifier - Log and Antilog amplifiers - Differentiator, Integrator - Comparators -Schmitt Trigger – Precision Rectifier – First order Low pass filter.

UNIT IV	TIMER, PLL, ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	9

Astable and Monostable Multivibrators using IC555 - Monolithic PLL IC565 – Voltage Controlled Oscillator. Sample and Hold circuit, D/A converter: Weighted Resistor type - R-2R Ladder type – Inverted R - 2R Ladder type. A/D Converters: Flash type - Successive Approximation type.

UNIT V	WAVEFORM GENERATOR & SPECIAL FUNCTION ICs	9

Square Wave Generator- Triangular Wave Generator ,IC Voltage Regulators: Fixed and Adjustable Voltage Regulators - IC 723 general purpose regulator – Switching Regulator - Power amplifier and Isolation Amplifier - Opto-couplers.

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LIST OF EXPERIEMNTS	15

1. Voltage Feedback Amplifiers
2. Current Feedback Amplifiers
3. RC Phase Shift Oscillator
4. Colpitts Oscillator
5. Diode Clippers, Clampers
6. Differentiator using op-amp
7. Integrator using op-amp
8. Low pass filter using op-amp
9. PLL characteristics
10. Instrumentation amplifier using Op-Amp

Text Book (s)	
1	D.RoyChoudhry, ShailJain,Linear Integrated Circuits,New Age International Pvt.Ltd. 4th edition,2010, Reprint, 2014.
2	Ramakant A.Gayakwad, OP-AMP and Linear ICs, Prentice Hall / Pearson Education, 4th Edition, 2001.

Reference (s)	
1	Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, Tata McGraw-Hill, 2007.
2	Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
3	David A. Bell, Electronic Devices & Circuits, 4th Edition, PHI, 2007
4	B.Rashid M, Microelectronics Circuits, Thomson Learning, 2007.
5	Microelectronic circuits -Adel Sedra and Kenneth C. Smith
6	Millman J and Halkias.C. Integrated Electronics, TMH, 2007.
7	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd, 2012

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Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC206T	TRANSMISSION LINES AND WAVEGUIDES	3	1	0	4

Prerequisite Course (s)

Electromagnetic Fields

Course Objective (s): The purpose of learning this course is to:

1	Introduce the various types of transmission lines and its characteristics
2	Impart technical knowledge in impedance matching using smith chart
3	Analyze the characteristics of TE, TM, TEM of parallel Planes
4	Design and analyze waveguides to meet with different frequency
5	Understand the concepts of cavities.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Able to analyze the different types of transmission line
CO2	Able to understand the different impedance matching techniques
CO3	Able to analyze the characteristics of TE, TM, TEM of parallel Planes
CO4	Able to analyze the rectangular and circular waveguide to meet the frequency requirements
CO5	Able to analyze the Rectangular and circular cavity resonators

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	2	1	-	1	3	3
CO2	3	2	2	2	-	-	-	2	2	1	-	1	3	3
CO3	2	2	2	2	-	-	-	2	2	1	-	1	3	2
CO4	3	2	2	2	-	-	-	2	2	1	-	1	2	3
CO5	2	2	2	2	-	-	-	2	2	1	-	1	2	2
CO (Avg)	2.6	2	2	2	-	-	-	2	2	1	-	1	2.6	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	TRANSMISSION LINE THEORY	12

The transmission line - general solution –Characteristic Impedance-The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line –Inductance loading of telephone cables–Reflection on a line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II	HIGH FREQUENCY TRANSMISSION LINES	12

Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line –Input Impedance of open and short-circuited lines - Impedance matching - The eighth wave line – The quarter wave line – the half wave line - The Smith Chart – Application of the Smith Chart– single stub matching and double stub matching- Solutions of problems using Smith chart

UNIT III	GUIDED WAVES BETWEEN PARALLEL PLANES	12

Waves between parallel planes of perfect conductors – Transverse electric waves - Transverse magnetic waves – Characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation – Attenuation of TE and TM waves in parallel planes – Wave impedances.

UNIT IV	RECTANGULAR WAVEGUIDES	12

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes inrectangular waveguides – Wave impedances– Excitation of modes

UNIT V	CIRCULAR WAVE GUIDES AND RESONATORS	12

Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular waveguides – wave impedances– Excitation of modes in circular waveguides – Microwave cavities, Rectangular cavity resonator, Circular cavity resonator

Text Book (s)

1	J.D.Ryder "Networks, Lines and Fields", PHI, New Delhi, 2003.
2	E.C. Jordan and K.G.Balmain "Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003

Reference (s)

1	Samuel Y. Liao, Microwave Devices and Circuits, Third Edition, Pearson India, 2017
2	G.S.N Raju, Electromagnetic Field Theory and Transmission Lines, Pearson Education, First Edition - 2005.

3	B.Somanathan Nair, Transmission Lines and Wave guides, Sanguine Technical publishers,2006.
4	David M.Pozar: Microwave Engineering – 2nd Edition – John Wiley 2000.

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC207T	SIGNALS AND SYSTEMS	3	1	0	4

Prerequisite Course (s)

Circuit analysis, Calculus and Transforms.

Course Objective (s): The purpose of learning this course is to:

1	Classify the different types of signals and systems
2	Understand the mathematical transforms for CT signal analysis
3	Understand the Fourier and Laplace transform for CT system design
4	Understand the concept of sampling process and Z-transform
5	Apply mathematical knowledge to design DT systems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Deliver the definition of signals and systems
CO2	Apply the Fourier series /Transform and Laplace transform to analyse the CT signals
CO3	Apply the Fourier Transform and Laplace transform for system design and analyse
CO4	Apply the Z-transform and DTFT for DT signal analysis
CO5	Apply the Z transform and DTFT for DT system design

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	-	1	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	1	-	-	-	-	-	2	3	3
CO4	3	3	3	3	-	1	-	-	-	-	-	2	3	3
CO5	3	3	3	3	-	1	-	-	-	-	-	2	3	3
CO (Avg)	3	3	3	2.8	-	1	-	-	-	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	12

Representation of signals, Elementary of signals – Step, Ramp, Impulse, Pulse, Exponential – Classification of Continuous Time(CT) and Discrete Time(DT) signals – periodic and aperiodic, even and odd, energy and power, deterministic and random – Operation on signals, CT and DT systems, properties of systems –memory systems, linearity, time invariance, causality, stability, invertibility.

UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS	12

Fourier series analysis of periodic signals, properties of Continuous Time Fourier Series (CTFS) – Continuous Time Fourier Transform (CTFT) and properties, Laplace Transform in signal analysis and properties, Inverse Laplace Transform.

UNIT III	ANALYSIS OF CONTINUOUS TIME SYSTEMS	12

Convolution integrals, Analysis and characterization of LTI systems of CTFT and Laplace Transform – computation of impulse response and transfer function using Laplace Transform, frequency response of systems characterized by difference equations, State variable equations and matrix representation of systems.

UNIT IV	SAMPLING THEOREM AND ANALYSIS OF DISCRETE TIME SIGNALS	12

Representation of CT signals by its sample – Sampling theorem – Reconstruction of a signal from its samples, aliasing – Discrete Time Fourier Transform (DTFT) and analysis – properties, Z-transform and properties.

UNIT V	ANALYSIS OF DISCRETE TIME SYSTEMS	12

Convolution sum, Analysis and characterization of LTI systems of DTFT and Z-transforms, Frequency response of systems characterized by differential equations - computation of impulse response and transfer function using Z-transforms - Block diagram representation – direct form I, direct form II, cascade and parallel forms.

Text Book (s)

1	Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, 2007.
2	B P Lathi, "Linear Systems and Signals", Oxford University Press, Chennai, 2nd Edition,2009

Reference (s)

1	S.Palani, "Signals and Systems", Ane's Book Pvt. Ltd, Delhi 2009.
2	V.Krishnaveni, A.Rajeswari, "Signals and Systems", Wiley, India, 2013.
3	Roberts Michael J. "Fundamentals of Signals and Systems", Tata McGraw-Hill, New Delhi, 2008.
4	Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley & sons, Inc, 2004.
5	H P Hsu, Rakesh Ranjan, "Signals and Systems", Tata McGraw Hill, Indian Reprint, 2007

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC208J	MICROPROCESSOR AND MICROCONTROLLER	3	0	2	4

Prerequisite Course (s)

Digital Electronics

Course Objective (s): The purpose of learning this course is to:

1	Study the Architecture of 8086 microprocessor.
2	Study about communication and bus interfacing
3	Study the Architecture of 8051 microcontroller
4	Study the interfacing in micro controller
5	Acquire the knowledge of embedded system design using MSP430 microcontrollers.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Design and implement programs on 8086 Microprocessor.
CO2	Design Memory Interfacing circuits.
CO3	Design and implement 8051 Microcontroller based systems
CO4	Able to discuss about the interfacing in Microcontroller
CO5	Identify the fundamental need of Low power embedded system

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	3	2	-	2	3	3
CO2	3	2	3	2	-	-	-	-	3	2	-	2	2	3
CO3	3	3	2	2	2	-	-	-	3	2	-	2	3	3
CO4	3	2	3	2	2	-	-	-	3	2	-	2	3	2
CO5	3	3	2	2	2	-	-	-	3	2	-	2	3	3
CO (Avg)	3	2	2.6	2	2	-	-	-	3	2	-	2	2.8	2.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	8086 MICROPROCESSOR	9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II	8086 I/O INTERFACING	9

. Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller

UNIT III	8051 MICROCONTROLLER	9

Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT IV	8051 INTERFACING MICROCONTROLLER	9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

UNIT V	INTRODUCTION TO MSP430	9

Motivation for MSP430 microcontrollers- Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. MSP430 RISC CPU architecture, Compiler-friendly features, &Instruction set.

LIST OF EXPERIMENTS	15

1. Arithmetic and Logical Operation using 8086Microprocessor.
2. Programming with 8086- Code Conversion and Matrix Multiplication.
3. Interfacing with 8086-Parallel Communication Interface
4. Interfacing with 8086-Serial Communication Interface.
5. Interfacing of ADC/ DAC with8086
6. Interfacing with 8086 - Keyboard and Display Controller.
7. Interfacing with 8086 – Traffic lightcontroller

8. Arithmetic and Logical Operation using 8051Microcontroller.

9. Stepper motor Interfacing with 8051Microcontroller

Text Book(s)	
1	Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay , "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education,2011.
3	Chris Nagy, Embedded Systems Design Using the TI MSP430 Series, Newnes publisher, 2003.
Reference (s)	
1	Kenneth Ayala, "The Microcontroller Architecture - Programming and Applications", 3rd Edition, Cengage Learning,2004.
2	N. Senthil Kumar, M. Saravanan, S. Jeevananthan "Microprocessors and Microcontrollers", 2nd Edition, Oxford Higher Education, 2018.
3	Douglas V.Hall and SSSP Rao, " Microprocessors and Interfacing", third edition , Tata Mc Graw Hill ,2012.

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Regulation 2018		Semester IV	Total Hours			30
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18MBM202L	CRITICAL AND CREATIVE THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Focus on listening, speaking, & writing skills through audio & video sessions
2	Hone soft skill and analytical ability of students
3	Overcome the fear in group communication and to provide the effective communication
4	Expertise intelligible pronunciation, stress and intonation patterns

Course Outcome (s) (Cos):

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

CO1	Solve both analytical and logical problems in an effective manner
CO2	Demonstrate an ability to design and deliver messages
CO3	Improve their communication with practical experience

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	-	2.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	Module - 1	6
Aptitude: Time and Work - Pipes and Cisterns. **Communication:** Sentence Pattern - **Debate.**		
UNIT II	Module - 2	6
Aptitude: Boats and Streams. **Communication: Tenses and voices - Tech Talk.**		
UNIT III	Module - 3	6
Aptitude: Problems on Ages - **Probability** **Communication:** Analogies - **Biography.**		
UNIT IV	Module - 4	6
Aptitude: Data sufficiency - Logical Puzzles. **Communication:** Punctuation - **Connection.**		
UNIT V	Module - 5	6
Aptitude: Mensuration. **Communication:** Preposition - **News of the** Week.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	**Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015**

Regulation 2018		Semester III/ Semester IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM103T	INDIAN TRADITION AND HERITAGE	1	0	0	-

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Make students understand the role and impact of culture in human life.
CLR-2	Draw attention towards languages and literatures of ancient period.
CLR-3	Cultivate secularism in students
CLR-4	Equip students with the knowledge of Indian art and architectural evolution over years.
CLR-5	Make students identify Indian culture in abroad.

Course Outcome (s) (Cos):

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

CO1	Understand the meaning of culture, trace the influence and significance of geographical features on Indian culture.
CO2	Develop an awareness of the variety of languages and literatures in India.
CO3	Recognise the characteristics of various religious movements in ancient India.
CO4	Identify the characteristics and various styles of Indian architecture and sculpture at different times.
CO5	Examine various modes through which Indian culture spread abroad.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	2	1	2	2	1	2	-	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-	-
CO4	2	2	2	2	2	2	2	2	2	2	1	2	-	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO (Avg)	**2**	**2**	**2**	**2**	**2**	**1.8**	**1.8**	**1.6**	**1.8**	**1.8**	**1**	**1.8**	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	HISTORY OF INDIAN CULTURE	2
Characteristics of Indian Culture - Significance of Geography on Indian Culture -Society in India through ages- Ancient Period - Varna and Jati, family and marriage in India - Position of women in ancient India- Contemporary period; Caste system and communalism.		
UNIT II	**LITERATURE AND EDUCATION**	**4**
Evolution of script and languages in India : Harappan Script and Brahmi Script, Short History of the Sanskrit Literature: The Vedas, The Brahmanas and Upanishads and Sutras, Epics: Ramayana and Mahabharata&Puranas - History of Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Sangam Literature and Odia Literature.		
UNIT III	**RELIGION AND PHILOSOPHY**	**4**
Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainisim, Indian Philosophy - Vedanta and Mimansa school of Philosophy.		
UNIT IV	**ART AND ARCHITECTURE**	**2**
Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Budhhist Architecture, Medieval Architecture and Colonial Architecture, Indian Painting Tradition, Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Rise of modern theatre and Indian cinema.		
UNIT V	**SPREAD OF INDIAN CULTURE ABROAD**	**3**
Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World through ages.		
Text Book (s)		
	Nil	
Reference (s)		
Chakravarti, Ranabir: Merchants, Merchandise & Merchantmen, in: Prakash, Om (ed.): *The Trading World of the Indian Ocean, 1500-1800 (History of Science, Philosophy and Culturein Indian Civilization*, ed. by D.P. Chattopadhyaya, vol. III, 7), Pearson, Delhi, 2012.		

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Regulation 2018		Semester V	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC301J	DIGITAL SIGNAL PROCESSING	3	0	2	4

Prerequisite Course (s)

Signals and Systems

Course Objective (s): The purpose of learning this course is to:

1	Understand the concept of DFT and FFT algorithms.
2	Study the design methods of digital filters
3	Know the Quantization noise in digital filters.
4	Study the fundamentals of Multirate Digital Signal Processing
5	Study the Architecture concepts of digital signal processors.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Compute DFT and FFT algorithms
CO2	Design the FIR and IIR filters.
CO3	Understand the quantization noise in filters and avoiding.
CO4	Understand the Multirate Digital Signal Processing.
CO5	Understand the DSP Processors.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	1	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	2	-	-	-	-	1	-	-	3	2
CO5	3	2	1	-	-	-	1	-	-	1	-	1	3	2
CO (Avg)	3	2.8	2.2	2.5	1.7	-	1	-	-	1	-	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High

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UNIT I	DISCRETE FOURIER TRANSFORM	9

Discrete Fourier transform (DFT): Properties - Linear filtering using DFT - Filtering long data sequences: overlap save and overlap add method - Fast computation of DFT(FFT): Radix-2 Decimation-in-time (DIT), Decimation-in-frequency (DIF).

UNIT II	DESIGN OF DIGITAL FILTER	9

IIR FILTER: Design of IIR filters from analog filters (LPF, HPF) -Design of Digital Butterworth and Chebyshev filter using impulse invariance technique and bilinear transformations.

FIR FILTER:

Linear Phase FIR Filter characteristics - Design of Digital FIR Filter using windowing (LPF, HPF) Technique (Rectangular, Hamming, Hanning, Triangular) and frequency sampling method.

UNIT III	FINITE WORD LENGTH EFFECTS	9

Quantization noise : truncation and rounding error, derivation for quantization noise power , Direct & Cascade Form- Types of Quantization:input quantization error, product quantization error, coefficient quantization error – limit cycle oscillations and dead band - signal scaling.

UNIT IV	MULTIRATE DIGITAL SIGNAL PROCESSING	9

Introduction to Multirate signal processing- Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor - Sampling rate conversion by a rational factor - Multistage implementation of sampling rate conversion - Applications of Multirate signal processing.

UNIT V	DSP PROCESSORS	9

Features of DSP processors – Fixed point Vs floating point DSP processor – Memory architecture of a DSP processor: Von Neumann and Harvard – Architecture of TMS320C5x- instruction set – Addressing Modes – Architecture of TMS320C8x Processor- Application of DSPs

LIST OF EXPERIMENTS	15

1. Computation of DFT of a signal using basic equation and FFT & power spectrum estimation using DFT.
2. Spectrum Analysis using DFT
3. Compute Convolution for longer sequence
4. Design of IIR filters using bilinear transformation .
5. Design of FIR filter using windowing method .
6. Compute and calculate the dead band for a second order system.
7. Design and compute the upsampling and downsampling
8. Arithmetic operations in Processor

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9. Generation of square and saw tooth waveform s using Processor.	
Text Book (s)	
1	John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.(Recent Edition)
2	S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, TMH/McGraw Hill International, 2000. (Recent Edition)
Reference (s)	
1	S.K.Mitra- "Digital Signal Processing- A Computer based approach"- Tata McGraw-Hill- 2006- New Delhi.
2	Allan V.Openheim, Ronald W.Sehafer & John R.Buck –"Discrete Time Signal Processing", second edition-Pearson/Prentice Hall.
3	A.Nagoor Kani - "Digital Signal Processing", second edition-Tara Mcgraw hill Pearson.
4	B.Venkataramani & M-Bhaskar- Digital Signal Processor Architecture- Programming and Application-TMH 2003 (UNIT V).
5	P.Ramesh Babu – Digital Signal Processing-latest edition-TMH

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC302T	ANTENNAS AND WAVE PROPAGATION	3	0	0	3

Prerequisite Course (s)

Electromagnetic Fields,Transmission Lines and waveguides

Course Objective (s): The purpose of learning this course is to:

1	Understanding the working principles of antenna and performance of antenna arrays.
2	Describe the application of all types of antennas.
3	Recognize the different types of propagation of radio waves at different frequencies.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Review the working of antenna and various antenna parameters.
CO2	Describe the radiation fields of various antennas.
CO3	Analyze the importance of Resonant and Non-Resonant antennas.
CO4	Explain the various antenna parameters measurements techniques.
CO5	Identify the various types of wave propagation in different layers of atmosphere.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	-	-	-	-	-	-	2	1	3	3
CO2	3	3	3	2	-	-	-	-	2	-	1	1	3	2
CO3	3	3	3	2	-	-	-	-	-	-	1	1	3	2
CO4	3	2	2	2	-	-	-	-	2	-	1	1	3	-
CO5	3	3	2	2	-	-	-	-	-	-	1	1	3	-
CO (Avg)	3	2.6	2.6	2.2	-	-	-	-	2	-	1.2	1	3	2.3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	ANTENNA FUNDAMENTALS	9
Basic antenna parameters: Radiation patterns, Beam solid angle, Radiation intensity- Directive gain- Directivity- Power gain- Beam Width-Gain, Effective aperture, Antenna field zones, Reciprocity principle- Relation between Effective length and Effective area. Retarded vector potential, Fields associated with Hertzian dipole- Power radiated and radiation resistance of current element.		
UNIT II	**WIRE ANTENNAS AND ANTENNA ARRAYS**	**9**
Radiation from half-wave dipole and quarter-wave monopole antennas, Folded dipole. **Antenna Arrays:** Expression for electric field from two and N element arrays linear arrays: Broad-side array and End-Fire array- Method of pattern multiplication-Binomial array- Horizontal and Vertical antennas above the ground plane.		
UNIT III	**ANTENNA TYPES**	**9**
Loop Antennas: Radiation from small loop and its radiation resistance- Radiation from a loop with circumference equal to a wavelength- Helical antenna: Normal mode and axial mode operation- Log periodic antenna- Horn antenna- Yagi-uda Antenna- Reflector antennas: Parabolic reflectors and their feed systems.		
UNIT IV	**SPECIAL ANTENNA AND ANTENNA MEASUREMENTS**	**9**
Microstrip antenna: Feeding Methods- Rectangular Patch. **Special Antenna:** Plasma Antenna, GPR, UWB and Wearable antennas. Antenna Measurements: Measurement of different Antenna parameters: Directional pattern, Gain, Phase, Polarization, Impedance, Efficiency.		
UNIT V	**PROPAGATION OF RADIO WAVES**	**9**
Ground wave propagation: Calculation of field strength at a distance- Flat earth and Curved earth concept. **Space wave propagation:** Reflection from ground for vertically and horizontally polarized waves- Duct propagation. **Sky wave propagation:** Structure of atmosphere - Critical frequency - Skip distance- Virtual height- Maximum usable frequency.		

Text Book (s)	
1	Constantine A. Ballanis, "Antenna Theory: Analysis and Design", John Wiley and Sons, Third Edition, 2016.
2	Prasad K.D., "Antennas and Wave Propagation", 3rd Edition, Satya Prakashan Publications, New Delhi 2013.
Reference (s)	
1.	G.N.S. Raju, "Antennas and Wave Propagation", McGraw-Hill, 4th Edition, 2010
2.	Jordan E.C and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, Reprint 2011
3.	John D. Kraus, Ronald J Marhefka and Ahmad S. Khan, —Antennas and Wave Propagationl, 4th Edition, McGraw Hill, New Delhi, 2010.

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC303T	ANALOG COMMUNICATION	3	0	0	3

Prerequisite Course (s)

Probability and Random Process

Course Objective (s): The purpose of learning this course is to:

1	Understand the modulation, demodulation, design and types of Amplitude modulation schemes.
2	Disseminate the students with the technique for generating and demodulating narrowband frequency, wideband frequency and phase modulated signals.
3	Understand the Performance of CW modulation systems and Information theory

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the generation and detection of amplitude modulation systems
CO2	Discuss the narrowband and wide band frequency signals and implement the FM system for the purpose of broadcasting.
CO3	Summarize the concepts of random process by analyzing the effect of noise in communication systems.
CO4	Review of noise performance of various receivers in communication systems.
CO5	Apply the coding schemes in Information theory.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	-	-	-	-	3	-	-	-	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO5	3	3	2	2	-	-	-	-	3	-	-	-	3	3
CO (Avg)	3	3	1.8	1.8	-	-	-	-	3	-	-	-	3	2.2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	AMPLITUDE MODULATION SYSTEMS	9
Basic blocks of Communication System - Generation and demodulation of AM techniques – Square law modulator and Detector - Balanced modulator, switching modulator, Envelope detector - Generation and Detection of DSB - SC - Balanced modulator, Ring modulator, Linear detector and Envelope detector, Generation and detection of SSB - SC - Phase and frequency discrimination, Coherent detection – VSB, High Power and Low power transmitter, Super heterodyne Receiver		
UNIT II	**ANGLE MODULATION SYSTEMS**	**9**
Basic Principles – Types of Angle Modulation: Frequency Modulation, Phase Modulation –Narrow Band FM & Wide Band FM - Transmission Bandwidth of FM signals - Generation of FM signal - Direct FM - Indirect FM - Demodulation of FM signals ,PLL		
UNIT III	**NOISE PERFORMANCE**	**9**
Noise – Types : External and Internal Noise - Shot noise, thermal noise, White noise – Signal-to-Noise Ratio - Noise Figure - Noise Temperature -Noise equivalent Bandwidth – Narrowband noise – Representation of Narrowband noise in terms of envelope and phase components		
UNIT IV	**PERFORMANCE OF CW MODULATION SYSTEMS**	**9**
Noise in AM receivers threshold effect - Noise in DSB-SC receiver – Noise in SSB receiver – Noise in FM receivers capture effect – FM threshold effect – FM threshold reduction– Pre-emphasis and de-emphasis in FM – Comparison of performance of AM and FM Systems.		
UNIT V	**INFORMATION THEORY**	**9**
Discrete Messages and Information Content, Concept of Amount of Information, Average information, Entropy, Information rate - Shannon-Fano coding, Huffman coding, Shannon"s Theorem, Channel Capacity - Rate Distortion Theory		

Text Book (s)	
1	Simon Haykin, Communication Systems, John Wiley & sons, NY, 5th Edition, 2009.
2	Wayne tomasi, Electronic Communications system:Fundamentals through , 5 th Edition,Pearson Education India
Reference (s)	
1	Sam Shanmugam, "Digital and Analog Communication Systems", 2nd ed, John Wiley, 1992.
2	Leon W. Couch II, " Digital and Analog Communication Systems", Prentice Hall, 1997
3	Michael P. Fitz, "Fundamentals of Communication Systems" Tata McGraw-Hill,Edition-2008.

Regulation 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM301L	ANALYTICAL AND LOGICAL THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Sharpen problem solving skills and to improve thinking capability of the students
2	Drive the students to use language with great commitment and cooperation
3	Expertise the creative thinking and presentation skills to meet the company needs

Course Outcome (s) (Cos):

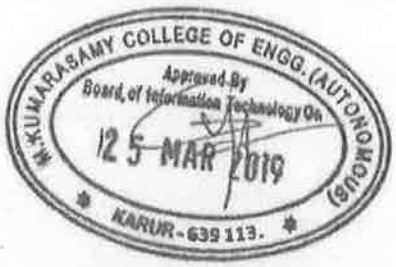
At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in a fruitful manner
CO2	Organize and convey the information in such an incomparable way
CO3	Improve their presentation skills

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	2	-	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	Module - 1	6
Aptitude: Alligations or Mixtures - Blood Relations. **Communication:** How to set Goals - Interpersonal Relationships - JOHARI Window - Work & Business Etiquette		
UNIT II	Module - 2	6
Aptitude: Partnership - Statement and Assumptions. **Communication:** Transition to Corporate World - Career opportunities in Various Sectors and know your industry.		
UNIT III	Module - 3	6
Aptitude: Arithmetic and Geometric Progressions - Syllogisms. **Communication:** Time Management - Anger and Stress Management - Conflict Management.		
UNIT IV	Module - 4	6
Aptitude: Permutations and Combinations - Statements & Conclusions. **Communication:** Launch a Product - Telephonic Etiquette.		
UNIT V	Module - 5	6
Aptitude: Geometric Problems. **Communication:** Presentation Skills - Oral presentation and public speaking skills, Business presentations.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester V/VI	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM302T	SELF DEVELOPMENT AND ENTREPRENEURSHIP	1	0	0	Nil

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Develop entrepreneurship and self-employment abilities to start any venture plan, use, and monitor and control resources optimally and economically.
2	Know the Micro, small and medium industries Registration Process.
3	Study about product selection and development.
4	Learn about the Project report preparation.
5	Analysis the Enterprise risk management.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify entrepreneurial quality.
CO2	Know the entrepreneurial support agencies.
CO3	Prepare project setup planning and project report
CO4	Select appropriate agencies for technical and financial support.
CO5	Explain SWOT analysis and strategies to achieve goals.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	1	1	1	-	-
CO2	-	1	-	-	-	2	1	1	1	2	2	1	-	-
CO3	1	3	-	-	-	-	2	1	1	1	2	1	-	-
CO4	-	1	-	-	-	1	2	1	1	1	2	1	-	-
CO5	2	1	-	-	-	-	1	-	1	1	1	1	-	-
CO (Avg)	1.50	1.50	-	-	-	1.33	1.50	1.00	1.00	1.20	1.60	1.00		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO SELF-EMPLOYMENT AND ENTREPRENEURSHIP DEVELOPMENT	6
Introduction of self-employment – Characteristics- Creativity. Entrepreneurship development-Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, importance of productivity, quality, cost consciousness and customers' satisfaction. Types of enterprise-Sole partnership -Partnership firm- Joint stock company- Co-operative society.		
UNIT II	**ENTREPRENEURIAL SUPPORT AGENCIES**	**6**
Definition – Micro, small and medium industries- Registration process of an enterprise with Government agencies-Name, type and role of state and national level support agencies. Current state & National Level Promotional Schemes for establishment of new.		
UNIT III	**PROJECT SET UP PLANNING**	**6**
Product Selection: importance- Product development stages. Process Selection: Factors affecting process selection - Technology lifecycle. Process Conversion-Capacity Planning: Basic method to assess / estimate capacity. Selection of location and layouts: Factors affecting selection of location - Objectives and types of plant layout.		
UNIT IV	**PROJECT PROPOSAL PLANNING**	**6**
7-M resources- Marketing- definition, need for enterprise, 4Ps channels- Market survey. Methods - Project report preparation for mechanical feature based product: Meaning of project planning and report: Feasibility study. Details required for preparing project plan. Project cost estimation.		
UNIT V	**ENTERPRISE AND RISK MANAGEMENT**	**6**
Concept of risk in the context of enterprise/ project-Uncertainty and certainty of project elements-Decision making under risk-Methods of risk management-Strength, Weakness, Opportunity and Threat (SWOT) analysis.		

Reference (s)

1	Entrepreneurship & Venture Management, Clifford and Bombak, JosephR.Momanso.
2	Small Industries management – Karmakar.M.B.
3	Creativity –Pradeep Khandwala
4	Entrepreneurship development and Management, R.K.Singal, S.K.Kataria Sons.

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Regulation 2018		Semester VI	Total Hours			30
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
H	18MBH201T	MANAGEMENT PRINCIPLES FOR ENGINEERS	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Enable the students to study the evolution of management.
2	Study about planning tools and techniques in management for engineers.
3	Learn about career planning for engineers.
4	Enable the effective and barriers communication in the organization.
5	Study the system and process of effective controlling in the organization.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Acquired the knowledge on fundamental concept of management and its various functions.
CO2	Gained knowledge on planning and decision making process.
CO3	Attained the knowledge of organization structure and career planning.
CO4	Demonstrate the ability to directing, leadership and communicate effectively.
CO5	Analysis isolates issues and formulates best control methods.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	1	-	-	1	-	1	2	-	-
CO2	2	2	-	-	-	1	-	-	1	1	1	1	-	-
CO3	2	-	-	-	-	1	-	-	-	-	1	2	-	-
CO4	1	-	-	-	-	1	-	-	1	1	1	-	-	-
CO5	2	-	-	-	-	1	-	-	-	1	1	3	-	-
CO (Avg)	1.80	2.00	-	-	-	1.00	-	-	1.00	1.00	1.00	2.00	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO MANAGEMENT PRINCIPLES	6
Meaning, Definition of Management – Managerial Role - POSDCORB -Management vs. Administration- Evolution of Management Thoughts- Henry Fayol's 14 Principles- Opportunities and Challenges in Management.		
UNIT II	PLANNING	6
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting - Objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		
UNIT III	ORGANIZING	6
Nature and purpose – Formal and informal organization – organization chart – Organization Structure– Types – Line and staff authority – Departmentalization – Delegation of Authority – Centralization and Decentralization – Job Design.		
UNIT IV	DIRECTING	6
Foundations of individual and group behavior – Motivation – Motivation Theories – Motivational - Techniques –Leadership – Types and Theories of Leadership – Communication – Process of Communication – Barrier in Communication – Effective Communication.		
UNIT V	CONTROLLING	6
System and Process of Controlling – budgetary and Non-Budgetary Control Techniques – Use of Computers and IT in Management control – Control and performance – Direct and Preventive control – Reporting.		

Reference (s)

1. P.C.Tripathi., P.N Reddy, Principles of Management, McGraw Hill, 5th Edition 2012.
2. Harold Koontz, Heinz Weihrich, A RamachandraAryasri, Tata McGraw Hill, Principles of Management, 2016
3. Charles W Hill, Stephen L Mcshane, Principles of Management, McGraw Hill, Special Indian Edition 2007.
4. 1.Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
5. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.

Regulation 2018		Semester VI	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC304J	Digital Communication	3	0	2	4

Prerequisite Course (s)

Probability Theory and Random Process, Signals and Systems

Course Objective (s): The purpose of learning this course is to:

1	Know the principles of sampling and quantization
2	Study the various combating technique for ISI
3	Learn the various digital modulation schemes for Pass band data transmission
4	Know the fundamentals of channel coding schemes and spread spectrum technique

Course Outcome (s) (Cos): At the end of this course, learners will be able to:

CO1	Understand Pulse modulation technique
CO2	Analyze combating technique for baseband binary transmission
CO3	Summarize the various Digital Modulation Schemes
CO4	Identify the errors using channel coding schemes
CO5	Explain the spread spectrum modulation for effective spectrum utilization

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	1	-	-	3	2
CO2	3	2	2	2	2	-	-	-	-	-	-	-	2	2
CO3	2	3	2	-	2	-	-	-	-	-	-	-	3	2
CO4	3	2	2	2	1	1	1	-	-	1	-	1	2	2
CO5	2	2	2	2	-	1	-	-	-	-	-	1	3	2
CO (Avg)	2.6	2.4	2.2	2	1.7	1	1	-	-	1	-	1	2.6	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	PULSE MODULATION	9
Sampling Process – Quantization process – PAM, PWM, PPM - PCM - Noise considerations in PCM Systems – Differential pulse code modulation -Delta modulation - Adaptive Delta Modulation- TDM - Digital multiplexers		
UNIT II	**BASEBAND PULSE TRANSMISSION**	**9**
Matched Filter – Inter symbol Interference - Nyquist's criterion for Distortion less Base band Binary Transmission - Correlative level coding – Adaptive Equalization –Eye patterns		
UNIT III	**PASS BAND DATA TRANSMISSION**	**9**
Introduction – Pass band Transmission model- Generation, Detection, Signal space diagram, bit error probability and Power spectra of BPSK, QPSK, QAM, MSK, FSK schemes – Comparison of Digital modulation systems using a single carrier		
UNIT IV	**ERROR CONTROL CODING**	**9**
Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolution codes - Viterbi Algorithm -Turbo Codes		
UNIT V	**SPREAD SPECTRUM MODULATION**	**9**
Pseudo- noise sequences –spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain –Probability of error – Frequency hop spread spectrum –Maximum length and Gold codes		

LIST OF EXPERIMENTS — **15**

1. Verification of Sampling theorem
2. Study of Pulse analog modulation (PAM, PWM and PPM)
3. Design and implementation of PCM and DPCM
4. Design and Implementation of Delta modulator
5. Design and implementation of ASK, FSK and PSK
6. Simulation of Duo binary Signaling
7. Simulation of BPSK Modulation and Demodulation
8. Simulation of QPSK Modulation and Demodulation
9. BER Analysis of BPSK and QPSK over AWGN
10. Study of linear block code error control coding technique

Text Book (s)

1	Simon Haykin, "Digital Communication Systems" John Wiley, 4th Edition, 2013
2	John G. Proakis, "Digital Communication" McGraw Hill 5e Edition, 2008

Reference (s)

1	Bernard Sklar and Pabitra Kumar Ray, Digital Communications: Fundamentals & Applications, 2/E, Pearson Education, 2009
2	Sam K. Shanmugam "Analog and Digital Communication" John Wiley, 2006
3	Taub and Schilling, "Principles of Digital Communication" Tata Mc Graw Hill, 28th Reprint 2013

Regulation 2018		Semester VI	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC305J	MICROWAVE ENGINEERING	3	0	2	4

Prerequisite Course (s)

Transmission Lines and Wave Guides

Course Objective (s): The purpose of learning this course is to:

1	Know the concepts of waveguide components
2	Understand the Microwave tubes
3	Study Microwave semiconductor devices
4	Become familiar with the concepts of Microwave measurements
5	Study the microwave applications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the various waveguide components
CO2	Discuss the Microwave sources
CO3	Describe the operation of Microwave semiconductor devices.
CO4	Analyze the microwave measurements
CO5	Identify the concepts of microwave and its applications

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	-	-	-	-	3	3	3	3
CO2	3	2	2	3	2	1	-	-	-	-	1	3	3	2
CO3	2	2	2	2	2	1	-	-	-	-	2	2	1	2
CO4	3	3	2	3	2	1	-	-	-	-	3	3	3	1
CO5	2	2	1	2	2	1	-	-	-	-	1	2	2	1
CO (Avg)	2.6	2.4	1.8	2.6	2.2	1	-	-	-	-	2	2.6	2.4	1.8

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	MICROWAVE NETWORK THOERY AND MICROWAVE COMPONENTS	9

Microwave frequencies, Microwave Devices, Microwave systems, Microwave units of measure. S parameters, Microwave Hybrid circuits: Waveguide Tees, Magic Tees, Hybrid Rings and Waveguide Corners, Bends, Twists. Directional Couplers: S Matrix of a Directional Coupler. Hybrid Couplers. Microwave Circulators and Microwave Isolators.

UNIT II	MICROWAVE TUBES	9

Klystrons: Reentrant Cavities, Velocity modulation Process, Bunching Process, Output Power and beam loading – Multicavity Klystron Amplifiers - Reflex Klystrons: Velocity modulation, Power Output and efficiency, Electronic Admittance - Helix Traveling Wave Tubes: Slow Wave structures, Amplification Process, Convection Current, Axial Electric Field, Wave Modes, Gain Consideration

UNIT III	MICROWAVE SEMICONDUCTOR DEVICES	9

Gunn Effect Diodes - GaAs Diode – Ridely Watkins Hilsum (RWH) Theory: Differential Negative Resistance, Two Valley Model Theory and High Field Domain - Modes of Operation - Read Diode - IMPATT Diodes - TRAPATT Diodes - BARITT Diodes - Parametric Devices: Physical Structures, Nonlinear Reactance and Manley Rowe Power Relations, Parametric Amplifiers, Applications

UNIT IV	MICROWAVE MEASUREMENTS	9

Spectrum Analyzer, Network Analyzer, Power measurements, Bolometer Sensor, Power Meter, Thermocouple sensor, High power measurement by the calorimetric method - Insertion loss and Attenuation measurements – VSWR Measurements - Return loss measurement by Reflectometer – Impedance Measurement – Frequency Measurement

UNIT V	APPLICATIONS OF MICROWAVES	9

Microwave Radar Systems, The Radar Equation, Duplexer, Pulsed Radar, CW Radar, Tracking Radars, Microwave Communication Systems, Terrestrial Systems, Satellite Communication Systems, Industrial Application of Microwaves, Microwave Heating, Industrial Control and Measurements, Thickness Measurements, Moisture Content Measurements, Medical Applications

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12 OCT 2020
KARUR - 639 113

LIST OF EXPERIMENTS	15

1.Characteristics of Reflex Klystron Oscillator.

2. Characteristics of Gunn diode Oscillator.

3. Study of Power Distribution in directional coupler.

4. Study of power distribution in E / H -Plane Tee, Magic Tee.

5. VSWR Measurements – Determination of terminated impedance.

6. Radiation Pattern of Horn antenna.

7. Determination of guided wavelength, frequency measurement.

8. Measurement of load Impedance using slotted line method and calculate using smith chart.

9. Characteristics of Circulator and Isolator.

Text Book (s)	
1	Samuel Y. Liao, "Microwave Devices and Circuits" Third Edition, Pearson India, 2011.
2	Annapurna Das and Sisir K Das, "Microwave Engineering", TMH, New Delhi, 2008
Reference (s)	
1	David M.Pozar, "Microwave Engineering", Fourth Edition, Wiley, 2011.
2	G.P.Srivastava, V.L.Gupta, "Microwave Devices and Circuit Design", Prentice Hall India Private Limited, First Edition, 2006.

Regulation 2018		Semester VI	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM302L	EMPLOYABILITY SKILLS AND PRACTICES	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Learn the application of mathematical or statistical models to different real-world contexts
2	Focus on writing & speaking skills through vigorous practices.
3	Enhance soft skills and analytical ability of students
4	Defeat the fear while communicating in group and to master the effective communication

Course Outcome (s) (Cos):

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

CO1	Solve both analytical and logical problems in a productive manner
CO2	Launch their ability of comprising and delivering the information
CO3	Upgrade their communication quality in near future

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	3	-	-	-			
CO3	-	-	-	-	-	-	-	-	-	3	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	3.00	3.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Time and Distance (Speed, Streams) - Problems on Trains - Arrangements and BloodRelations. **Communication:** Job Application - Cover letter,Bio-data,Resume& CV building.		
UNIT II	**Module - 2**	**6**
Aptitude: Time and Work - Pipes & Cisterns - Situation Reaction Test & Data Interpretations. **Communication: Writing practices on circulars, notices, memos, Agenda** preparation and Minutes of meeting.		
UNIT III	**Module - 3**	**6**
Aptitude: Ages - Averages - Probability - Profit and Loss. **Communication:** Email Etiquette - **Essay writing.**		
UNIT IV	**Module - 4**	**6**
Aptitude: Mensuration - SI & CI - Cause and **Effect Analysis - Statement, Assumptions &** Conclusions. **Communication:** Group Discussion **and guidelines.**		
UNIT V	**Module - 5**	**6**
Aptitude: Permutation and Combinations - Partnership - Alligations or Mixtures. **Communication:** Interview skills - General instructions, Review of interview questions, Mock Interviews.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

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Approved By
Board of Information Technology On
25 MAR 2019
KARUR-639 113.

Regulation 2018		Semester V/ VI	Total Hours			15
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18LEM301T	INDIAN ART FORMS (Common to all UG Programmes)	1	0	0	-

Prerequisite Course (s)	
NIL	
Course Objective (s): The purpose of learning this course is to:	
CLR-1	Introduce the learners to various art forms and whet their aesthetics sense.
CLR-2	Improve learners' knowledge on history of theatre and drama and draw connections between theatrical practices and social contexts in both modern and pre modern periods..
CLR-3	Enable the learners to identify and understanding various types of dance and music concepts
CLR-4	Make learners explore the diversity of Architecture, Sculpture, Painting and its intersection with community, culture and society.
CLR-5	Make students to get familiarized with the formal, historical, and theoretical aspects of literary arts.
Course Outcome (s) (COs): At the end of this course, learners will be able to:	
CO1	Identify aesthetics traits found throughout Indian art.
CO2	Demonstrate understanding of the social and artistic movements that have shaped theatre and dance.
CO3	Recognize different concepts involved in music and dance.
CO4	Identify and appreciate the salient features and various styles of Indian Architecture, Sculpture and Painting at different times.
CO5	Demonstrate a broad understanding of Indian literary arts and appreciate the role that historical context plays in the creation and Interpretation of literary works

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO3	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO4	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO5	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	1	2	2	1.6	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	**INDIAN ARTS**	3
Introduction to art (aesthetics, taste)- fine arts - applied arts –Terminology - Subject matter -Art as propaganda - Purposes/uses of art.		
UNIT II	**THEATRE & DRAMA**	3
History of Theatre and Drama- Traditional Theatre forms- Modern Theatre and its characteristics- Puppetry –different forms and elements of drama.		
UNIT III	**MUSIC AND DANCES**	3
Origin of Music and Dance- Classical music and Carnatic Music- Regional Music -Musical Instruments-Regional Classical Dances.		
UNIT IV	**ARCHITECTURE, SCULPTURE, PAINTING**	3
History of architecture, sculpture, painting -Indo-Islamic Architecture- Temple Architecture– different types of Sculptures and its characteristics-Painting and its different styles.		
UNIT V	**LITERARY ARTS**	3
Ancient Indian Literature- Early Dravidian Literature- Medieval Literature- Modern Indian Literature-Contemporary Literature.		

Text Book (s)	
	NIL
Reference (s)	
1	Dhar, Parul Pandya, ed., 2011, Indian Art History Changing Perspectives, New Delhi: D.K. Print world and National Museum Institute (Introduction).
2	Guha-Thakurta, Tapati, The making of a new modern Indian art: Aesthetics and nationalism in Bengal, 1850-1920, Cambridge University Press, 1992
3	Huntington, Susan, The Art of Ancient India: Hindu, Buddhist, Jain, Weatherhill, 1985
4	Mitter, Partha, Indian Art, Oxford History of Art series, Oxford University Press, 2001

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Regulation 2018		Semester VII	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH202T	SOCIAL ENGINEERING	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Learn about fundamental concept of social engineering
2	Know the different elements of ethical hacking and social engineering.
3	Understand the concepts of threats and attack vectors
4	Understand the ethical hacking
5	Learn about the attacks against individuals and organizations

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concept of social engineering and types of attacks.
CO2	Identify the key security concepts, CIA and IT governance and best practices
CO3	Understand principles of social engineering.
CO4	Exhibit the ethical hacking concepts and scopes, threats and attack vectors and common areas of vulnerability.
CO5	Gain knowledge of attacks against individuals and organizations.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	1	1	1	1	1	-	1	-	-
CO2	1	1	-	-	-	2	-	2	1	-	-	1	-	-
CO3	-	1	-	-	-	-	1	2	1	-	-	1	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	1	-	-
CO5	1	1	-	-	-	-	-	-	1	1	-	1	-	-
CO (Avg)	1.33	1.25	-	-	-	1.50	1.00	2.00	1.00	1.00		1.00		-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO SOCIAL ENGINEERING	6
Social Engineering Defined - Why Does Social Engineering Work - Identify Communication Style - key aspects of social engineering - Categories of Social Engineering Attacks – human – based attacks and technology - based attacks		
UNIT II	**KEY SECURITY**	**6**
Key security - concepts - Types of key security concepts – Cyber security position. The CIA Triad - the significance of incident response and frameworks around cyber security. IT Governance - Best practices - compliance.		
UNIT III	**PSYCHOLOGY OF SOCIAL ENGINEERING**	**6**
Mind Tricks: Psychological Principle - Four fundamental aspects of human nature that social engineers - the desire to be helpful - the tendency to be trusting - the fear of offending others - the tendency to cut corners		
UNIT IV	**ETHICAL HACKING AND SOCIAL ENGINEERING**	**6**
Ethical Hacking Concepts and Scopes - Threats and Attack Vectors - Information Assurance - Threat Modelling - Enterprise Information Security Architecture - Vulnerability Assessment and Penetration Testing - Types of Social Engineering - Insider Attack - Preventing Insider Threats - Social Engineering Targets and Defence Strategies. Common Areas of Vulnerability - Appropriate access - Assessed resistance - Information availability		
UNIT V	**CASES OF SOCIAL ENGINEERING**	**6**
Notable Cases of Social Engineering - Attacks against Individuals - Attacks against Organizations - Preventing Social Engineering Attacks - Mitigating the Damage of Social Engineering Attacks - Segregation of Access - Maintain Access Logs - Ensure That Backups Occur Regularly - Automatically Revoke User Privileges If Suspicious Activity Is Detected		

Reference (s)

1	Kevin D. Mitnick, William L. Simon, Steve Wozniak, The Art of Deception: Controlling the Human Element of Security, Wiley, October 17th 2003
2	Christopher Hadnagy, Social Engineering: The Science of Human Hacking Paperback- Wiley Publishing Inc.,Edition 2018
3	Lester Evans, Cybersecurity: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyberwarfare Paperback –2018
4	Dr. Erdal Ozkaya, Learn Social Engineering: Learn the art of human hacking with an internationally renowned expert-2018

Regulation 2018		Semester VII	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18ECC401T	WIRELESS COMMUNICATION	3	0	0	3

Prerequisite Course (s)

Analog Communication, Digital Communication

Course Objective (s): The purpose of learning this course is to:

1	Achieve comprehensive understanding of the cellular path loss and shadow models
2	Understand the concept of multipath models and its capacity analysis
3	Study the various types of Modulation along with its bit error rate analysis.
4	Know the various issues in transmit and receive diversity analysis.
5	Learn about the various frequency standards of multicarrier modulation

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the cellular concept of Wireless Communication Systems.
CO2	Describe the Mathematical model of a wireless channel and determine the capacity of wireless systems in Rayleigh fading & frequency selective fading environments.
CO3	Determine the BER performance of digital modulation schemes in fading environment.
CO4	Apply the concept of multiple input and multiple output (MIMO) to mitigate fading effect in wireless Communication Systems.
CO5	Determine the performance of OFDM based wireless communication systems in fading environment.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	1
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	1	-	-	-	1	-	-	-	-	-	3	2
CO5	3	3	2	1	1	1	-	-	1	1	-	1	3	2
CO (Avg)	3	2	1.5	1	1	1	1	-	1	1	-	1	3	1.6

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	WIRELESS FUNDAMENTALS	9

Cellular concept - Path loss and shadowing: Radio Wave Propagation - Transmit and Receive Signal Models - Free-Space Path Loss - Ray Tracing - Empirical Path Loss Models - Simplified Path Loss Model - Shadow Fading - Combined Path Loss and Shadowing.

UNIT II	STATISTICAL MULTIPATH MODELS AND CAPACITY ANALYSIS	9

Time-Varying Channel Impulse Response - Narrowband Fading Models - Wideband Fading Models - Capacity of Flat fading Channels - Channel and system model - Channel Distribution Information (CDI) Known - Channel Side Information at Receive - Channel Side Information at transmitter and receiver - Capacity of frequency selective fading Channels - Time Invariant Channels - Time varying Channels.

UNIT III	BER ANALYSIS	9

Digital Modulation and Detection: Signal Space analysis - Pass band modulation principles - Amplitude and Phase Modulation - Frequency modulation - Pulse shaping - Error probability analysis in fading channels.

UNIT IV	SPATIAL DIVERSITY	9

Transmit Diversity: Channel known at transmitter - Channel unknown at transmitter- The Alamouti scheme - Receive Diversity: Selection combining - Equal Gain combining - Threshold Combining - Maximal Ratio Combining - Spatial Multiplexing in MIMO - Moment Generating functions in diversity analysis.

UNIT V	MULTICARRIER MODULATION	9

The multicarrier concept - Orthogonal Frequency Division Multiplexing (OFDM) basics - Multiple access for OFDM systems - Orthogonal Frequency Division Multiple Access (OFDMA) - Single Carrier Frequency Division Multiple Access (SCFDMA).

Text Book (s)

1	Andera Goldsmith,Wireless Communications,Cambridge University Press,2005.
2	Aditya.K.Jegannatham, "Principles of Modern Wireless Communication Systems",Tata-McGraw Hill, 2016.

Reference (s)

1	David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications", Cambridge University Press, 2006.
2	Rias Muhamed, Jeffrey G.Andrews, Jun Zhang, Arunaba Ghosh, "Fundamentals of LTE", Prentice Hall, 2010.
3	A.Paulraj, R. Nabar and D Gore, "Introduction to Space-Time Wireless Communications", Cambridge University Press, 2003.
4	Upena Dalal, "Wireless Communication", Oxford University Press, 2009.
5	John G. Proakis, "Digital Communications", McGraw Hill, 2000.

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Regulation 2018		Semester __	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE001J	VLSI Design	3	0	2	4

Prerequisite Course (s)

Digital Electronics, Integrated Circuits

Course Objective (s): The purpose of learning this course is to:

1	Understand the CMOS Fabrication Process and CMOS Circuits.
2	Study CMOS Circuits using various Logic Styles.
3	Provide basic knowledge about FPGA and VLSI System Design.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze of MOS Circuit Design Process.
CO2	Design and expose the CMOS circuits using various logic styles.
CO3	Analyze of CMOS circuit Characterization
CO4	Design Strategies for CMOS testing
CO5	Model the digital system using Verilog Hardware Description Language.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	1	1	-	-	-	2	3	1
CO2	3	3	2	2	2	-	1	1	-	-	-	2	3	1
CO3	3	3	2	2	-	-	1	1	-	-	-	2	3	1
CO4	3	3	2	2	-	-	1	1	-	-	-	2	3	1
CO5	3	3	2	2	3	-	1	1	-	-	-	2	3	2
CO (Avg)	**3**	**3**	**2**	**2**	**2.5**	-	1	1	-	-	-	**2**	**3**	**1.4**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	MOS TRANSISTOR THEORY	9

CMOS Technology: n-well, p-well - Twin tub and SOI Process- VLSI Layout Design: Layout design rules- Lambda Design Rules- Stick Diagram: examples. MOS Transistor Theory: Basic MOS transistors: symbols, Enhancement mode transistor operation – Second order effects – Small signal AC characteristics - NMOS inverter - Determination of pull up to pull down ratio - CMOS inverter - DC Characteristics.

UNIT II	CMOS LOGIC STYLES AND PROGRAMMABLE DEVICE	9

CMOS Logic Styles: Pass Transistor and Transmission Gate - Static CMOS design - Pseudo NMOS -dynamic CMOS logic - Clocked CMOS logic – domino CMOS logic.

FPGA: Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology -mapping for FPGAs, Xilinx XC4000

UNIT III	CMOS CIRCUIT CHARACTERIZATION	9

Switching Characteristics: analytical delay model-Empirical delay model- Gate delays - Power dissipation: Static Dissipation- Dynamic Dissipation- Short circuit Dissipation-Total Power Dissipation- charge sharing- Design margining- Reliability.

UNIT IV	TESTING	9

Need for testing- Manufacturing Test Principles -Design Strategies for Test: Design for Testability – Ad-hoc Testing – Scan based test Techniques- System level test techniques.

UNIT V	VERILOG HDL DESIGN	9

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

LIST OF EXPERIMENTS	15

1. Verilog HDL based design entry and simulation of combinational circuits (4-bit min).
2. Verilog HDL based design entry and simulation of sequential circuits.
3. Verilog HDL based design entry and simulation of state machine.
4. Synthesis, P&R and post P&R simulation of 4-Bit Serial Adder.
5. Synthesis, P&R and post P&R simulation of 4-Bit Parallel Adder/Subtractor.
6. Design and Synthesis of 4-Bit Multiplier using Xilinx ISE Simulator.
7. Basic logic gates using T-Spice Tool.

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8. Design and simulation of a simple five transistor differential amplifier using T-spice and measure gain, ICMR, and CMRR.
9. Design a Real Time Clock and Demonstrate its Working on The FPGA Board.
10. Design and Testing of 8-Bit ALU on FPGA Board.

Text Book (s)	
1	Neil H E Weste and Kamran Eshranghian, "CMOS VLSI Design: A system Perspective", Addission Wesley, Third Edition, 1994.
2	John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Magic International Pvt. Ltd., 2014.
Reference (s)	
1	A.Pucknell, Kamran Eshraghian, "Basic VLSI Design", Third Edition, Prentice Hall of India, 2007.
2	Weste and Harris: CMOS VLSI Design (Third edition) Pearson Education, 2005
3	J. Bhaskar, "A Verilog HDL Primer", B. S. Publications, 2011.
4	M.J.S.Smith: Application specific integrated circuits, Pearson Education, 1997
5	John V.Oldfield, Richard C Dore, "Field Programmable Gate Arrays", Wiley Publications1995.

Regulation 2018		Semester__	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE002J	EMBEDDED SYSTEM DESIGN	3	0	2	4

Prerequisite Course (s)

Microprocessor and Microcontroller

Course Objective (s): The purpose of learning this course is to:

1	Study ARM Embedded systems and processor fundamentals
2	Learn ARM Organizations, Implementations and Processor cores
3	Understand ARM CPU cores and the AMULET asynchronous ARM processors
4	Enumerate the idea of EMBEDDED communication protocols and RTOS
5	Study system debugging and few applications of embedded systems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Acquire knowledge about ARM Embedded systems and processor fundamentals
CO2	Perform ARM Organizations, Implementations and Processor cores.
CO3	Learn the concepts of ARM CPU cores and the AMULET asynchronous ARM processors.
CO4	Understand the concepts of EMBEDDED communication protocols and RTOS.
CO5	Understand the concepts of system debugging and few applications of embedded systems

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	-	1	1	-	-	-	-	3	-
CO2	3	2	1	-	-	-	1	1	-	-	-	-	3	-
CO3	3	2	1	-	-	-	1	1	-	-	-	-	3	-
CO4	3	2	1	1	-	-	1	1	-	-	-	1	3	1
CO5	3	2	1	1	1	-	1	1	-	-	-	1	3	1
CO (Avg)	3	1.8	1	1	1	-	1	1	-	-	-	1	3	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	ARM EMBEDDED SYSTEMS AND PROCESSOR FUNDAMENTALS	9
The RISC Design Philosophy-Embedded System Hardware- Embedded System Software-Pipeline, Exceptions, Interrupts and Vector table-Core Extensions-ARM Instruction Set –Thumb Instruction Set.		
UNIT II	**ARM ORGANIZATIONS, IMPLEMENTATION AND PROCESSOR CORES**	**9**
ARM Organization: Three Stage Pipeline, Five Stage Pipeline - ARM Instruction Execution-**ARM Implementation:** ARM 6 ALU Structure, ARM High Speed Multiplier-Control Structure. **ARM Processor Cores:** ARM7TDMI-ARM8- ARM9TDMI-ARM10TDMI.		
UNIT III	**ARM CPU CORES AND THE AMULET ASYNCHRONOUS ARM PROCESSORS**	**9**
The ARM710T, ARM720T and ARM740T-ARM810-The Strong-Arm SA-110-The ARM920T and ARM940T-ARM946E-S and ARM966E-S-ARM1020E-Self-timed design-AMULET1-AMULET2-AMULET2e-AMULET3-The DRACO telecommunications controller.		
UNIT IV	**EMBEDDED COMMUNICATION PROTOCOLS**	**9**
Serial communication protocols: I^2C-USB-CAN Parallel communication protocols: PCI-X, ARM Bus Serial Peripheral Interface, Inter Integrated Circuits - Ethernet, Universal serial Bus - Controller Area Network, ISA / PCI Bus protocols.		
UNIT V	**SYSTEM DEBUGGING AND APPLICATIONS**	**9**
Debugging Features, Core Sight, Debug Modes, Debugging Events, Breakpoint, Accessing Register and Debugging Components, **Applications:** Telephone answering machine, Engine control unit ,Video accelerator		
	LIST OF EXPERIMENTS	**15**

ARM EXPERIMENTS:

1. Study of ARM LPC2148.
2. Interface - Flashing of LEDS, Keypad and LCD.
3. Interfacing EEPROM using I2C.
4. Interfacing Stepper motor.
5. Serial communication (UART) – Zigbee.
6. Interrupts Programming.
7. interfacing temperature sensor and upload the data in cloud through WiFi
8. interfacing pH sensor with ARM and testing the results in mobile phone through Bluetooth
9. interfacing ultrasonic sensor with ARM and measure the distance of the obstacle
10. AI with IoT based on ARM architecture for testing any sensor data with cloud.

Text Book (s)

1	Andrew N.SLOSS, Dominic SYMES and Chris WRIGHT "ARM System Developer Guide Designing and Optimizing System Software" Elsevier 2004
2	Steve Furber "ARM System-on-Chip Architecture" second edition PEARSON

3	Andrew N. Sloss Dominic Symes Chris Wright, "ARM System Developer"s Guide Designing and Optimizing System Software", Elsevier Inc 2010.
4	"The Definitive Guide to the ARM Cortex-M" Joseph Yiu, Elsevier- Newness, 2014
Reference (s)	
1	Dr.K.V.K.K Prasad "Embedded/Real-Time Systems: Concepts,Design & Programming" Dreamtech Press.
2	Raj Kamal "Embedded Systems Architecture, Programming and Design" Second Edition TATA McGRAW HILL
3	Shibu K.V, "Introduction to Embedded Systems", Mc Graw Hill.
4	Wayne Wolf, "Computers as Components - Principles of Embedded Computing System Design", Morgan Kaufman Publishers, First Indian Reprint, 2001.
5	David E.Simon, "An Embedded Software Primer", Pearson Education Asia, New York 2000.
6	Peter Barry Patrick Crowley "Modern Embedded Computing Designing Connected, Pervasive, Media-Rich Systems", Elsevier, 2012

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE003T	REAL TIME OPERATING SYSTEMS	3	0	0	3

Prerequisite Course (s)

Embedded systems

Course Objective (s): The purpose of learning this course is to:

1	Develop the skills for working in Real Time Systems
2	Acquire essential skills for developing various real time models.
3	Develop skills in working of µc/OS–II RTOS
4	Compare different types and Functionalities in RTOS.
5	Apply concepts of RTOS in real life problems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Schedule tasks in real time models using RTOS
CO2	Describe Various Real time models
CO3	Perform inter task communication in µC/OS– II RTOS
CO4	Describe Principles and design issues in RTOS Functions.
CO5	Develop various RTOS based applications.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	1	-	-	-	-	3	3	3	3
CO2	3	3	2	3	1	1	-	-	-	-	1	3	3	2
CO3	3	2	2	2	1	1	-	-	-	-	2	2	2	2
CO4	3	3	2	3	1	1	-	-	-	-	3	3	3	2
CO5	2	2	1	2	1	1	-	-	-	-	1	2	2	1
CO (Avg)	2.8	2.2	1.8	2.6	1	1	-	-	-	-	2	2.6	2.6	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	REAL TIME SYSTEMS	9
Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes –Distributed operating system – issues in distributed system: states, events, clocks-Distributed Scheduling-Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mailboxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks.		
UNIT II	**REAL TIME MODELS**	**9**
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.		
UNIT III	**RTOS CONCEPTS**	**9**
Foreground/Background process – Resources – Tasks – Multitasking – Priorities – Schedulers – Kernel – Exclusion –Intertask communication – Interrupts – Clock ticks – µC/OS– II Kernel structure – µC/OS– II Initialization – Porting µC/OS– II.		
UNIT IV	**RTOS FUNCTIONS**	**9**
Task Management – Time management – Semaphore management – Mutual exclusion – Event Management – Message management – Memory management.		
UNIT V	**RTOS APPLICATIONS**	**9**
Case studies-RTOS for Image Processing – Embedded RTOS for Network communication – RTOS for fault-Tolerant Applications – RTOS for Control Systems. Principles – Design issues –Comparison and Basic study of various RTOS like – VX works – RT Linux – Tiny OS		

Text Book (s)	
1	Krishna C.M., Kang G Shin, "Real–Time Systems", Tata McGraw–Hill Pub. Co. Ltd, 2011.
2	Jean J Labrosse, "Embedded Systems Building Blocks", CMP Books, 2005.
Reference (s)	
1	Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
2	Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE004T	ADVANCED MICROPROCESSORS AND MICROCONTROLLERS	3	0	0	3

Prerequisite Course (s)

Microprocessor and Microcontroller

Course Objective (s): The purpose of learning this course is to:

1	Impart design of high-performance processor
2	Learn about the various interfacing concepts
3	Know the design and architectural development of Special Purpose Processors.
4	Get exposed to the concepts of PIC Microcontroller.
5	Understand the multi core processor Architecture

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate the addressing capabilities and data types.
CO2	Discuss the addressing and multitasking concepts of RISC and CISC processors
CO3	Explain the hardware architecture and various applications of Special Purpose Processors.
CO4	Describe the architecture and memory organization of the PIC.
CO5	Discuss the concepts of general purpose multi core processor architecture

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	-	1	1	-	-	-	-	2	1
CO2	3	2	1	-	1	-	1	1	-	-	-	-	2	1
CO3	3	2	1	-	-	-	1	1	1	1	-	-	2	1
CO4	2	2	1	-	-	-	1	1	-	-	-	-	2	1
CO5	3	2	1	-	-	-	1	1	-	-	-	1	2	1
CO (Avg)	2.8	2	1	-	1	-	1	1	1	1	-	1	2	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	PENTIUM PROCESSOR	9
The software model – functional description – CPU pin descriptions – Addressing modes – Processor flags – Instruction set – Bus operations – Super scalar architecture – Pipe lining – Branch prediction – The instruction and data caches – Floating point unit– Programming the Pentium processor.		
UNIT II	**PENTIUM INTERFACE**	**9**
Protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input / Output – Virtual 8086 model – Interrupt processing		
UNIT III	**SPECIAL PURPOSE PROCESSORS**	**9**
Video codec design – Platforms – General purpose Processor – Digital signal processor – Embedded processor – Media Processor – Video signal Processor – Custom Hardware – Co-Processor.		
UNIT IV	**PIC 16F877 MICROCONTROLLER**	**9**
Architecture of PIC 16F877- Register file structure – CPU Register –Status Register- Instruction sets-Addressing modes –Memory organization: Program memory-Data memory-Oscillator and reset circuits.		
UNIT V	**MULTICORE ARCHITECTURE**	**9**
General-Purpose Multi-core Processors, CMP Design – Challenges and Opportunities: Power, System-Level Software Stack, Application Software and Workloads, Infrastructure Scalability, Multi-core AMD Opteron TM Processors :First-Generation Single-Core AMD Opteron Chips, Second- and Third-Generation AMD Opteron Micro architecture		

Text Book (s)

1	James L. Antonakos, "The Pentium Microprocessor", Pearson Education, 1997.
2	Iain E.G.Richardson, "Video codec design: Developing image and video compression systems", John Wiley & sons Ltd, U.K, 2002.
3	Peatman, John B., Design with PIC Microcontrollers, 8th Impression, Pearson Education, New Delhi, 2009.
4	Stephen W. Keckler, Kunle Olukotun, H. Peter Hofstee, Multicore Processors and Systems, Springer, 2009.

Reference (s)

1	Barry.B.Brey, "The Intel Microprocessors Architecture, Programming and Interfacing", PHI, 2002.
2	Ajay V Deshmukh " Microcontroller Theory and Applications" Tata McGraw Hill, 2007
3	PIC16f87x Datasheet - http://ww1.microchip.com/downloads/en/DeviceDoc/39582C.pdf

Regulation 2018		Semester __	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE005J	COMPUTER NETWORKS	3	0	2	4

Prerequisite Course (s)

Digital Electronics

Course Objective (s): The purpose of learning this course is to:

1	Build an understanding of the fundamental concepts of computer networking.
2	Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
3	Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Enumerate the Data Communications System, Layers of the Network models and their flow and error control methods.
CO2	Illustrate the functions of MAC layer and the IEEE standards of LAN and Wireless LAN.
CO3	Identify the different types of network devices and routing protocols and their functions
CO4	Interpret the skills of sub-netting, Transport control and Congestion control mechanisms
CO5	Infer the applications, and how they can be used to assist in network design and implementation.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	1	-	-	-	-	-	-	2	2
CO2	3	2	-	-	2	1	-	-	-	-	-	-	2	2
CO3	3	2	-	-	2	1	-	-	1	1	-	1	3	2
CO4	3	2	2	1	2	1	-	-	-	-	-	-	3	2
CO5	3	2	1	-	2	1	-	1	-	-	-	1	3	2
CO (Avg)	2.6	2	1	1	2	1	-	1	1	1	-	1	2.6	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	NETWORK ARCHITECTURE AND DATA LINK LAYER	9

Introduction: Overview of data communication-Topology – Protocols and standards - OSI architecture.TCP/IP Model-Introduction to data link layer-Error detection and correction-Flow Control: Stop and Wait – Error Control: Sliding window protocols (Go back N ARQ, Selective repeat ARQ).

UNIT II	MEDIUM ACCESS SUBLAYER	9

Medium Access layer: Random access - Controlled access - Wired LAN - IEEE 802.3: Standard Ethernet , Fast Ethernet, Gigabit Ethernet IEEE 802.4: Token Ring - IEEE 802.5: Token Bus - Virtual LANs-IEEE802.11-Bluetooth.

UNIT III	INTERNETWORK LAYER AND ROUTING ALGORITHMS	9

Connecting devices: Repeaters, Hubs, Switches and Gateways -Circuit switching- Packet switching - IPv4 - IPv6 – Address Mapping: ARP- Error Reporting: ICMP- Subnetting – Routing: Distance Vector Routing (RIP) – Link State Routing (OSPF) -Multicast routing: DVMRP-MOSPF.

UNIT IV	TRANSPORT LAYER	9

Process–to-Process delivery-User Datagram Protocol (UDP) –Transmission Control Protocol (TCP) – Stream Control Transmission Protocol(SCTP)- Congestion Control – Quality of services (QoS) – Techniques to improve QoS-Integrated services –Differential services.

UNIT V	APPLICATIONLAYER AND NETWORK SECURITY	9

Domain Name Space (DNS) - E-Mail-FTP- HTTP and SMTP- VoIP-TELNET-Security–Symmetric key Cryptography : DES, Triple DES, Asymmetric key Cryptography:RSA, Diffie Hellman, Firewalls.

LIST OF EXPERIMENTS	15

1. Implementation of Ethernet LAN Protocol for Star, Bus and Ring topology using Cisco Packet Tracer
2. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped
3. Implementation of Stop and wait protocol & sliding window protocol
4. Simulation of Go Back N protocol and Selective repeat protocols
5. Implementation of Distance vector routing algorithm using Cisco Packet Tracer
6. Implementation of Link state routing algorithm using Cisco Packet Tracer
7. Implementation of Transmission control protocol in sensor network
8. Implementation of Congestion control using leaky bucket algorithm
9. Implementation of Error detection and Error correction techniques
10. Implementation of Data encryption and decryption.

Text Book (s)	
1	Behrouz Foruzan, Data communication and Networking, Tata McGraw-Hill, 2013,5th edition.
2	James .F. Kurouse & W. Rouse, "Computer Networking: A Topdown Approach Featuring", Pearson Education,2006

Reference (s)	
1	Stallings.W, "Data and Computer Communication", Pearson Education, 10th Edition, 2013.
2	J.F.Kurkose& K.W.Rose,"Computer Networking-A top down approach", Pearson Education, 7th Edition, 2017.
3	Ed Tittle," Schaum's outlines - Computer Networking", McGraw Hill Professional, 2002.
4	Srinivasan Keshav, "An Engineering Approach to Computer Networking", Addision Wesley Professional, 2010.
5	Andrew S.Tanenbaum, David Wetherall, "Computer Networks", Pearson Education, 5th Edition, 2013.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE006T	AUTOMOTIVE EMBEDDED SYSTEMS	3	0	0	3

Prerequisite Course (s)

Embedded system

Course Objective (s): The purpose of learning this course is to:

1	Learn about the basic concepts of embedded system in Automobile engineering.
2	Understand the concepts of C codingof Automotive Embedded system
3	Study the ARM Modules of Automotive Embedded system
4	Study the concepts ofLIN protocol.
5	Analyse the Testing of Embedded system in Vehicle Network Diagnostics.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Remembering about the basics of Electronics in the Automotive Embedded Systems.
CO2	Understanding and apply drive by Programming of Automotive Embedded system and Embedded C & Coding Standards for Automotive.
CO3	Study andApplyingof the Introduction to ARM Microcontrollers, Architecture, Peripherals and Interfacing.
CO4	Analyzing the Automotive Protocol - Local Interconnect Network (LIN) using software.
CO5	Understand the testing methods of Vehicle Network Diagnostics.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	-	3	2	3	-	3	-	3	3
CO2	3	2	2	-	2	-	3	2	3	-	3	-	3	3
CO3	3	2	2	-	2	-	3	2	3	-	3	-	3	3
CO4	3	2	2	-	2	-	3	2	3	-	3	-	3	3
CO5	3	2	2	-	2	-	3	2	3	-	3	-	3	3
CO(Avg)	3	2	2	-	2	-	3	2	3	-	3	-	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO AUTOMOTIVE EMBEDDED SYSTEMS	9

Overview of present-day embedded products - Basic building blocks of embedded systems - Automotive Systems Overview -Embedded Technology in Automotive Industry -Embedded System Development Process - Tool Chain and Cross Compilation.

UNIT II	EMBEDDED C & CODING STANDARDS FOR AUTOMOTIVE	9

Introduction to C -Introduction to C Automotive Standard -Loops and Control Flow-Functions-Storage Class and Linkage –Macro –Arrays –Pointers -Structures, Unions and Enums -Data Structures.

UNIT III	INTRODUCTION TO ARM MICROCONTROLLERS, ARCHITECTURE, PERIPHERALS AND INTERFACING	9

Overview of Architecture Of Microcontroller -Introduction to Development Tools and Environment: Programmers, Debuggers, Emulators, Simulators, Development Board -Using On-Chip Peripherals for applications -Interfaces to External Peripherals: Display, Switch, ADC, Sensors.

UNIT IV	AUTOMOTIVE PROTOCOL - LOCAL INTERCONNECT NETWORK (LIN)	9

Introduction to CAN Protocol - Basics of CAN Standard and Extended -CAN communication -Basics of Implementation of CAN Protocols - CAN Bus Analyser Tool Chain - Fault simulations- Applications.

UNIT V	VEHICLE NETWORK DIAGNOSTICS	9

Process of Automotive Fault Diagnostics, Fault Codes - Vehicle Systems On- and Off- Board Diagnostics - Steps taken to diagnose a fault - Diagnostics Protocols – Industrial Standards.

Text Book (s)

1	"Embedded System Design: A unified Hardware / Software Introduction" – Frank Vahid and Tony Givargis, Wiley India Publishers.
2	"Automotive Embedded Systems" Handbook. Edited by Nicolas Navet and Françoise Simonot-Lion. Integration Technologies for Industrial Automated Systems.

Reference (s)

1	"C Programming for Embedded Systems" Kirk Zurell, R&D Books, CMP Media, KANSAS.
2	"Architecture, Programming and Interfacing of Low-power Processors-ARM 7, Cortex-M" by Lyla B. Das, 2017.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE007T	TESTING OF VLSI DESIGN	3	0	0	3

Prerequisite Course (s)

Digital Electronics, VLSI Design

Course Objective (s): The purpose of learning this course is to:

1	Study the concepts of basics of testing and fault modeling.
2	Understand the concepts of test generation for combinational and sequential circuits.
3	Study the concepts of design for testability.
4	Understand the concepts of self – test and test algorithms.
5	Study the concepts of fault diagnosis.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Summarize the concepts of basics of testing and fault modeling.
CO2	Review the test generation for combinational and sequential circuits.
CO3	Summarize the design for testability.
CO4	Summarize the concepts of self – test and test algorithms.
CO5	Review the concepts of fault diagnosis.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	1
CO2	3	3	3	1	-	-	-	-	-	-	-	-	3	1
CO3	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	2
CO5	3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO (Avg)	3	2.6	2.6	1.4	-	-	-	-	-	-	-	1	2.8	1.4

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	BASICS OF FAULT MODELLING AND TESTING FOR COMBINATIONAL CIRCUITS AND SEQUENTIAL CIRCUITS	9

Faults in Logic Circuits - Breaks and Transistors Stuck-Open and Stuck-On or Stuck-Open Faults in CMOS, Basic Concepts of Fault Detection, Test Generation for combinational Logic circuits - Path Sensitization - *D*-Algorithm – PODEM – FAN - Delay Fault Detection. Designing Checking Experiments for sequential circuits

UNIT II	LOGIC SIMULATION	9

Types of simulation – delay models – Element evaluation – Hazard detection - Gate level event driven simulation – Fault dominance – multiple stuck fault model – Fault simulation

UNIT III	DESIGN FOR TESTABILITY	9

Design for Testability – Ad-hoc design – generic scan-based design – classical scan-based design – system level DFT approaches.

UNIT IV	SELF – TEST AND TEST ALGORITHMS	9

Built-In self-Test – test pattern generation for BIST – Circular BIST – BIST Architectures – Testable Memory Design – Test Algorithms – Test generation for Embedded RAMs.

UNIT V	FAULT DIAGNOSIS	9

Logical Level Diagnosis – Diagnosis by UUT reduction – Fault Diagnosis for Combinational Circuits – Self-checking design – System Level Diagnosis.

Text Book (s)	
1	P.K. Lala, An Introduction to Logic Circuit Testing, Publication in the Morgan & Claypool Publishers series, Synthesis Lectures on Digital Circuits And Systems#17.
2	M.Abramovici, M.A.Breuer and A.D. Friedman, —Digital systems and Testable Design‖, Jaico Publishing House,2002.
Reference (s)	
1	P.K. Lala, —Digital Circuit Testing and Testability‖, Academic Press, 2002.
2	M.L.Bushnell and V.D.Agrawal, —Essentials of Electronic Testing for Digital, Memory and MixedSignal VLSI Circuits‖, Kluwer Academic Publishers, 2002.
3	A.L.Crouch, —Design Test for Digital IC's and Embedded Core Systems‖, Prentice Hall International, 2002.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE008T	ASIC DESIGN	3	0	0	3

Prerequisite Course (s)

Digital Electronics, VLSI Design

Course Objective (s): The purpose of learning this course is to:

1	Classify the types of ASIC and ASIC library design
2	Impact knowledge on programmable architectures for ASICs
3	Identify the key steps in designing an ASIC
4	Gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
5	Classify different algorithms used for optimization in ASICs

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze the different types of ASICs and logic cells used in ASIC design
CO2	Comprehend the different logic cell architecture
CO3	Explain design tools and interconnects in programmable logic cells
CO4	Develop knowledge in ASIC construction and Floor planning
CO5	Analyze routing and different optimization techniques

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	3	1
CO2	3	2	1	1	-	-	-	-	-	-	-	2	3	1
CO3	3	2	2	2	2	-	-	-	-	-	-	2	3	1
CO4	3	2	1	1	1	-	-	-	-	-	-	1	3	1
CO5	3	2	2	2	2	-	-	-	-	-	-	1	3	1
CO (Avg)	3	2	1.4	1.4	1.6	-	-	-	-	-	-	1.4	3	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	ASIC AND CMOS LOGIC DESIGN	9
Introduction-Types of ASICs - Design flow - Combinational logic cell – Sequential logic cell - Data path logic cell – ASIC Library design: Transistor as resistors -Transistor parasitic capacitance -Logical effort- Library cell design- Library architecture - gate array design- standard cell design - data path cell design.		
UNIT II	**PROGRAMMABLE ASIC LOGIC CELLS**	**9**
Anti-fuse- Types – Poly diffusion- Metal to metal anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks –Programmable Logic Cells: Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX -Xilinx I/O blocks.		
UNIT III	**PROGRAMMABLE ASIC INTERCONNECT AND DESIGN TOOLS**	**9**
Actel ACT - Xilinx LCA - Xilinx EPLD-Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX -Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation.		
UNIT IV	**ASIC CONSTRUCTION AND FLOOR PLANNING**	**9**
ASIC Construction: Physical Design- System Partitioning- FPGA Partitioning- Partitioning Methods. Floor planning and Placement: Floor planning- Placement- Physical Design Flow.		
UNIT V	**ROUTING AND OPTIMIZATION ALGORITHMS**	**9**
Routing: Global routing - detailed routing - special routing - circuit extraction – DRC-multichip modules (MCM) - Programmable logic arrays-Transistor chaining-Weinberger Arrays-Gate Matrix Layout-1D compaction-2D compaction.		

Text Book (s)

1	M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997.
2	FarzadNekoogar and FaranakNekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.

Reference (s)

1	Louise H. Crockett, Ross A. Elliot and Martin A. Enderwitz, "Zync–7000 All programmable SoC", Strathelyde Academic Media 2014.
2	Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
3	F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.
4	R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.

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Regulation 2018		Semester __	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE009J	INTERNET OF THINGS	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Introduce evolution of internet technology and need for IoT.
2	Discuss on IoT reference layer and various protocols and software
3	Train the students to build IoT systems using sensors, single board computers and open source IoT platforms.
4	Make the students to apply IoT data for business solution in various domain in secured manner.
5	Providing IoT Solutions with sensor-based application through embedded system platform

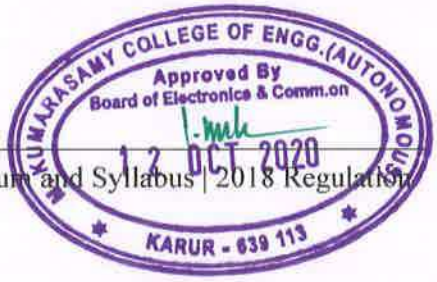
Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify the IoT networking components with respect to OSI layer.
CO2	Evaluate IoT solutions, design and develop IoT based sensor systems.
CO3	Analyze the IoT protocols and software.
CO4	Examine the wireless technologies for IoT.
CO5	Demonstrate the ideas of Developing IoT Solutions

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	1	-	2	3	2
CO2	3	3	2	-	1	1	-	-	-	1	-	2	3	2
CO3	3	3	2	-	-	-	-	-	-	1	-	2	3	2
CO4	3	3	2	1	1	-	-	1	-	1	-	2	3	2
CO5	3	3	2	1	-	1	1	1	-	1	-	2	3	2
CO (Avg)	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	-	1	-	**2**	**3**	**2**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	EVOLUTION OF IoT	9
Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer.		
UNIT II	**INTRODUCTION TO IoT COMPONENTS, PROTOCOLS AND SOFTWARES**	**9**
Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure, MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols.		
UNIT III	**IoT POINT TO POINT COMMUNICATION TECHNOLOGIES**	**9**
IoT Communication Pattern,IoT protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA).		
UNIT IV	**IoT SECURITY**	**9**
Need for encryption, standard encryption protocol, light weight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security.		
UNIT V	**DEVELOPING IoT SOLUTIONS**	**9**
Introduction to IoT tools, developing applications through IoT tools, Developing sensor-based application through embedded system platform and Artificial Intelligence (AI). Case studies: IoT for smart cities, health care, agriculture, Industrial IoT, Industry 4.0.		
	LIST OF EXPERIMENTS	**15**

1. Connect Arduino board and glow LED, Read analog and digital sensors such as relay, temperature, Humidity.
2. Load the OS in Raspberry pi.
3. Interface with Bluetooth and transmit sensor data to other node.
4. Interface with Zigbee and transmit sensor data to other node.
5. Mobile app to display cloud data.
6. Measure the light intensity in the room and output data to the web API.
7. Control your home power outlet from anywhere using raspberry pi, zigbee and Arduino.
8. Drinking water monitoring and analytics, consists of IoT device, cloud, and mobile and web app.

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Text Book (s)	
1	Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016.
2	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.
Reference (s)	
1	LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.
2	Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE010T	MACHINE LEARNING	3	0	0	3

Prerequisite Course (s)

Partial Differential Equations and linear Algebra, Probability Theory and Random Processes

Course Objective (s): The purpose of learning this course is to:

1	Acquire the fundamental of machine learning.
2	Learn supervised and unsupervised machine learning algorithms
3	Describe the differences in approaches and applicability of machine learning algorithms.
4	Able to formulate machine learning problems corresponding to different applications.
5	Understand how to program to a machine learning algorithm with python

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the fundamental concepts of machine learning
CO2	Implement supervised methods of machine learning
CO3	Employ unsupervised learning algorithms
CO4	Understand learning set of rules and reinforcement learning
CO5	Apply the machine learning algorithms to solve a problem with python programming

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	1	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	1	-	-	-	-	-	2	3	2
CO3	3	3	3	2	-	1	-	-	-	-	-	2	3	2
CO4	3	3	3	2	-	1	-	-	-	-	-	2	3	2
CO5	3	3	3	2	2	1	-	-	2	-	-	2	3	2
CO (Avg)	**3**	**3**	**3**	**2**	**2**	**1**	-	-	**2**	-	-	**2**	**3**	**2**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	FOUNDATIONS OF MACHINE LEARNING	9
Types of machine learning: Supervised learning- Unsupervised Learning-Reinforcement Learning- Machine LearningProcess-Terminologies: Weight Space, Curse of Dimensionality, Overfitting, Training, Testing, Validation Sets - Performance Measures: Confusion Matrix,Accuracy Metrics, Receiver Operator Characteristic (ROC) Curve,Measurement Precision- Model selection-No free lunch theorem- Bias-Variance Tradeoff		
UNIT II	**SUPERVISED LEARNING**	**9**
Decision Tree Learning: Representation, Algorithm, Hypothesis Space Search - Artificial Neural Networks: Perceptrons, Multilayer Networks and Back Propagation Algorithm - Naive Bayes Classifier - k-Nearest Neighbor algorithm, Support Vector Machines.		
UNIT III	**UNSUPERVISED LEARNING**	**9**
Principal Components Analysis, K-means Clustering, Hierarchical Clustering, Gaussian Mixture Models, Expectation Maximization (EM)algorithm.		
UNIT IV	**ADVANCED LEARNING**	**9**
Learning Sets of Rules: Sequential Covering Algorithm, Learning Rule Set, First Order Rules, Sets of First Order Rules, Induction on Inverted Deduction, Inverting Resolution - Analytical Learning: Perfect Domain Theories, Explanation Base Learning –FOCL Algorithm – Reinforcement Learning: Task, Q-Learning, Non-Deterministic Rewards and Actions,Temporal Difference Learning – Fuzzy Logic: Fuzzy Sets, Fuzzy Rules and Defuzzifications.		
UNIT V	**PYTHON MACHINE LEARNING**	**9**
Essential Python Libraries:NumPy, pandas, matplotlib, IPython, SciPy, Tensorflow - A roadmap for building machine learning systems– Preparation of Dataset –Testing of ANN, Decision Tree and Naïve Bayes Classifier using python.		

Text Book (s)	
1	Tom Mitchell, Machine Learning, McGraw-Hill, 1997.
2	Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2015
Reference (s)	
1	EthemAlpaydın, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press,Second Edition, 2004.
2	Stephen Marsland, "Machine Learning - An Algorithmic Perspective", 2nd Edition, CRC Press, 2015

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Regulation 2018		Semester__	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE011T	DIGITAL IMAGE PROCESSING	3	0	0	3

Prerequisite Course (s)

Digital Signal processing

Course Objective (s): The purpose of learning this course is to:

1	Learn the basic concept of digital image processing
2	Develop new image processing algorithm for different domains
3	Develop hybrid techniques to solve problem in different applications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Apply the mathematical transform necessary for image processing.
CO2	Compute the enhancement techniques using spatial and frequency filers.
CO3	Apply the restoration technique in the presence of noise and degradation.
CO4	Apply the concept of various segmentation techniques and representation.
CO5	Compute various compression and recognition methods.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO2	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO3	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO4	3	2	1	1	-	-	1	-	-	-	-	1	3	1
CO5	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO (Avg)	3	2	1	1	-	-	1	-	-	-	-	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	DIGITAL IMAGE FUNDAMENTALS	9
Elements of digital image processing systems– Elements of Visual perception–Image sampling and quantization–Basic Relationships between pixels- Color image fundamentals - RGB- HSI models - Image Transforms: Cosine–Hadamard-Walsh transforms.		
UNIT II	**IMAGE ENHANCEMENT**	**9**
Image enhancement in spatial domain– Gray level transformation techniques–Histogram Processing: Histogram Equalization, Histogram Matching– Spatial filters: Smoothing, Sharpening– Frequency Domain Filters: Smoothing and Sharpening–Homomorphic filters.		
UNIT III	**IMAGE RESTORATION**	**9**
Degradation model – Noise Models– Restoration in the presence of noise only: spatial filtering-Inverse and wiener filtering – Constrained least square filtering. Morphological Image Processing: Preliminaries – Erosion – Dilation – Duality – Opening – Closing.		
UNIT IV	**IMAGE SEGMENTATION AND REPRESENTATION**	**9**
Edge detection–Edge linking via Hough transform – Thresholding – Region based segmentation: Region growing, Region splitting and merging –Watershed segmentation algorithm. **Representation:** Boundary representation: Boundary segments, signatures, skeletons-Regional Descriptors: Topological feature, Texture		
UNIT V	**IMAGE COMPRESSION AND RECOGNITION**	**9**
Need for data compression– Error free compression: Huffman, Run Length Encoding, Arithmetic coding– Lossy Compression: Lossy predictive coding, Transform coding, Data loss due to compression in real time application – Lossless compression- Standards: JPEG and MPEG. Recognition: Patterns and Pattern classes – Recognition based on: matching, string matching.		

Text Book (s)	
1	Rafael C.Gonzalez, Richard E.Woods, Digital Image Processing', Pearson,Second Edition 2004.
2	Dr.S.Jayaraman, Digital Image Processing TMH New Delhi ,2009.
Reference (s)	
1.	Anil K.Jain, "Fundamentals of Digital Image Processing", Pearson Education 2003
2.	Sridhar.S, "Digital Image Processing", Oxford University Press, First Edition – 2011
3.	David Salomon, "Data Compression: The Complete Reference", Springer, Verlag NewYork Inc-- 2nd Edition-2001
4.	William K-Pratt- 'Digital Image Processing'- John Wiley- NewYork- 2002
5.	Kenneth R.Castleman-"Digital Image Processing"-Pearson-2003

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE012T	COGNITIVE RADIO	3	0	0	3

Prerequisite Course (s)

Digital Communication

Course Objective (s): The purpose of learning this course is to:

1	Know the basics of the software defined radios
2	Learn the design of the wireless networks based on the cognitive radios
3	Understand the concepts of wireless networks and next generation networks

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify the difference between SDR and HDR.
CO2	Discuss the functions and modules of SDR architecture.
CO3	Describe the cognitive techniques and artificial intelligence techniques.
CO4	Summarize the cognition cycle, functions and architecture maps.
CO5	Use the cognitive radio concept in next generation wireless networks.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	2	-	-	-	-	-	1	-	-	-	3	2
CO3	3	1	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	1	1	-	-	-	1	-	-	-	-	-	3	2
CO5	3	1	1	-	1	1	-	-	1	-	1	1	2	2
CO (Avg)	3	1.4	1.6	-	1	1	1	-	1	-	1	1	2.8	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO SOFTWARE DEFINED RADIO	9
Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications		
UNIT II	**SDR ARCHITECTURE**	**9**
Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules		
UNIT III	**INTRODUCTION TO COGNITIVE RADIOS**	**9**
Making radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques		
UNIT IV	**COGNITIVE RADIO ARCHITECTURE**	**9**
Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.		
UNIT V	**NEXT GENERATION WIRELESS NETWORKS**	**9**
The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.		

Text Book (s)	
1	Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2	Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
Reference (s)	
1	Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005
2	Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE013T	WIRELESS EMBEDDED SYSTEMS	3	0	0	3

Prerequisite Course (s)

Embedded Systems

Course Objective (s): The purpose of learning this course is to:

1	Describe about the generation of wireless systems.
2	Impart concepts of security in wireless system.
3	Understand the network requirement and about the network management of CAN message.
4	Study the basic principle of CAN open standard network configuration and simulations.
5	Identifying and implementing CAN open

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the different generation of wireless systems.
CO2	Understand the concepts of security in wireless system.
CO3	Know about requirement of Embedded network
CO4	Understand the network configuration and simulations also about CAN.
CO5	Understand implementing CAN open

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	3	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	3	1
CO (Avg)	**3**	**2**	**1**	1	-	-	-	-	-	-	-	**1**	**2.8**	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	AN OVERVIEW OF WIRELESS SYSTEMS	9

Introduction-First- and Second-Generation Cellular Systems-Cellular Communications from 1G to 3G-Road Map for higher Data Rate Capability in 3G-Wireless 4G Systems-Future Wireless Network-Standardization Activates for Cellular Systems

UNIT II	SECURITY IN WIRELESS SYSTEMS	9

Introduction-Purpose of security-Privacy Requirements-Required Features for a secured Wireless Communications System-Methods of Providing Privacy and Security Wireless Systems-Wireless security and Standards-IEEE 802.11 Security-Security in North American Cellular/PCS Systems-Security in GSM,GPRS, and UMTS.

UNIT III	EMBEDDED NETWORK REQUIREMENTS	9

Embedded networking-Communication in the Automation Pyramid-Terminology used in Embedded Networking-Code Requirements for Embedded Systems-Communication Requirements for Embedded Networking-Introduction to CAN open from the Application Level-The Object Dictionary Concept-Electronic Data Sheets

UNIT IV	CAN open STANDARD	9

CAN open Object Dictionary-Data Types-Mandatory Entries-Reading the CAN open Specification-The Electronics Data Sheets (EDC) and Device Configuration Files (DCF)- Accessing the CAN open object Dictionary (OD)with Service Data Objects (SDO)-Handling Process Data with Process Data Objects-TPDO Transmit Trigger Options-SYNC Terminology-Network Management

UNIT V	IMPLEMENTING CAN open	9

Communication Layout and Requirements-Comparison of Implementation Methods-CAN open Hardware Modules or Chips-CAN open Source Code-Code Configuration through Conditional Compilation –Object Dictionary-CAN open Conformance Test-Choosing an Implementation Path-Implementing CAN open Compliant Bootloaders.

Text Book (s)	
1	Vijay Garg, "Wireless Communication and networking",First Edition,Elsevier 2007.
2	GlafP.Feiffer AndrewAyre and Christian Keyold, "Embedded networking with CAN and CANopen",Embedded System Academy 2005.
Reference (s)	
1	William Stallings, "Wireless communication and Networking" Second edition Prentice Hall,India 2007.
2	Jon W Mark,WeihuaZhuang "Wireless communication and Networking" Prentice Hall India 2003.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE014T	HIGH SPEED NETWORKS	3	0	0	3

Prerequisite Course (s)

Computer Networks

Course Objective (s): The purpose of learning this course is to:

1	Expose about the concept of ATM and Frame relay
2	Provide with an up-to-date survey and developments in High Speed networking
3	Enable the students to know the techniques involved to support real-time traffic and congestion control
4	Study the integrated and differentiated services with random early detection
5	Understand the protocols for QOS Support

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Recognize various types of High-speed networks
CO2	Analyze the congestion control techniques for ATM and TCP networks
CO3	Identify the traffic management schemes
CO4	Discuss Integrated and Differentiated services
CO5	Summarize different protocols to achieve the required QOS

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	3	2
CO2	2	-	-	-	-	-	-	-	3	-	-	3	2	2
CO3	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	2	-	-	-	-	-	-	3	-	-	3	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO (Avg)	2.8	2.25	2	2	-	-	-	-	3	-	-	3	2.4	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	HIGH SPEED NETWORKS	9
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11		
UNIT II	**CONGESTION AND TRAFFIC MANAGEMENT**	**9**
Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.		
UNIT III	**TCP AND ATM CONGESTION CONTROL**	**9**
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN"s Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.		
UNIT IV	**INTEGRATED AND DIFFERENTIATED SERVICES**	**9**
Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services		
UNIT V	**PROTOCOLS FOR QOS SUPPORT**	**9**
RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP		

Text Book (s)

1.	William Stallings, "High Speed Networks and Internet", Second Edition, Pearson Education, 2002.
2.	Warland, PravinVaraiya, "High performance communication networks", Second Edition, Jean Harcourt Asia Pvt. Ltd. 2001

Reference (s)

1.	Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", CRC Press, New York, 2004
2.	Irvan Pepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE015T	BIOMEDICAL INSTRUMENTATION	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation, Analog Electronics

Course Objective (s): The purpose of learning this course is to:

1	Gain knowledge about the various physiological parameters both electrical and non-electrical
2	Gain knowledge about the various bio-chemical and non-electrical parameter measurement
3	Gain knowledge about the methods of recording and also the method of transmitting these parameters.
4	Study about the various assist devices used in the hospitals.
5	Gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate the Origin of Bioelectric potential and their measurements using appropriate electrodes and Transducers.
CO2	Articulate how to measure various biochemical and nonelectrical parameters of human system
CO3	Illustrate the various Assist and Therapeutic Devices
CO4	Describe the working principles of various Imaging techniques
CO5	Summarize the recent trends in medical instrumentation

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	-	-	-	-	-	-	-	1	-	1	2	1
CO (Avg)	3	2	1	-	-	-	-	-	-	1	-	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ELECTRO -PHYSIOLOGY AND BIO -POTENTIAL RECORDING	9
The origin of Bio-potentials; bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, typical waveforms and signal characteristics		
UNIT II	**BIO-CHEMICAL AND NON-ELECTRICAL PARAMETER MEASUREMENT**	**9**
PH, PO2, PCO2, Colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure measurement, temperature measurement, pulse measurement and Blood cell counters		
UNIT III	**ASSIST DEVICES AND BIO-TELEMETRY**	**9**
Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart Lung Machine, Ventilators, Insulin Pumps- Telemetry-Biotelemetry, radio-pill and tele-stimulation.		
UNIT IV	**RADIOLOGICAL AND IMAGING EQUIPMENTS**	**9**
Ionizing radiation, Diagnostic x-ray and its principle of operation, CT and its principle of operation, Ultrasonic imaging equipment's, use of Radio Isotope in diagnosis-MRI and its principle of operation, PET- Thermograph and endoscopy unit.		
UNIT V	**RECENT TRENDS IN MEDICAL INSTRUMENTATION**	**9**
Laser in medicine, Diathermy units, Electrical safety in medical equipment, Application of Nanotechnology in bio electronics-Brain machine interface, Pneumatic driver for total artificial heart and Lab on a chip.		

Text Book (s)

1	Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA McGraw -Hill, New Delhi, 2003.
2	Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2007.)

Reference (s)

1	Joseph J.Carr and John M.Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 2004.
2	John G Webster, Ed, "Medical Instrumentation Application and Design", Fourth edition, John Wiley & Sons, Singapore, 2007

Regulation 2018		Semester__	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE016T	SENSORS AND ACTUATORS	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation

Course Objective (s): The purpose of learning this course is to:

1	Understand different types of displacement sensors
2	Understand the proximity, force and pressure sensors
3	Review the velocity, flow and level sensors
4	Outline the concepts of temperature, motion and light sensors
5	Explain the working principle of micro sensors and actuators

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Able to explain the concept of different displacement sensors
CO2	Able to know the proximity, force and pressure sensors
CO3	Able to infer the working of velocity, flow and level sensors
CO4	Able to infer the concepts of temperature, motion and light sensors
CO5	Able to illustrate the working principle of micro sensors and actuators

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	2	2	-	-	-	-	-	2	-	2	3	2
CO5	3	2	2	2	-	-	-	-	-	2	-	2	3	2
CO (Avg)	3	2	2	2	-	-	-	-	-	2	-	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION AND DISPLACEMENT MEASUREMENT	9

Sensors - Basic requirements of a sensors- Classification of sensors- Static and Dynamic characteristics of sensors- Displacement Sensors- Linear and Rotary displacement sensors-Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.

UNIT II	MEASUREMENT OF PROXIMITY, FORCE AND PRESSURE	9

Eddy current proximity sensor- Inductive Proximity sensor- Capacitive Proximity sensor -Pneumatic Proximity sensors- Proximity Switches- Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule Pressure sensors- Bellows Pressure Sensor- Bourdon tube pressure sensor- Piezoelectric Sensor- Tactile sensor.

UNIT III	MEASUREMENT OF VELOCITY, FLOW AND LEVEL	9

Tachogenerator - Pyroelectric sensors - Ultrasonic sensor – Resistive sensor- Pitot tube – Orificeplate - flow nozzle- Venturi tubes – Rotameter- Electromagnetic flow meter. Float level sensor- Pressure level sensor- Variable capacitance sensor.

UNIT IV	MEASUREMENT OF TEMPERATURE, MOTION AND LIGHT SENSORS	9

Thermocouples- Thermistors -Thermodiodes - Thermotransistors- BimetallicStrip- Resistance Temperature Detector- Infrared Thermography. Vibrometer and accelerometer- seismic accelerometer. Photoresistors -Photodiodes - Phototranistors- Photocondutors.

UNIT V	MICRO SENSORS AND ACTUATORS	9

Micro Sensors: Principles and examples, Force and pressure micro sensors,position and speed micro sensors, acceleration micro sensors, chemical sensors,biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles. Neumatic linear actuators, Hydraulic Actuators, Electrical actuators and Fluid power system

Text Book (s)

1	Sensors and Actuators: Control System Instrumentation, Clarence W. de Silva CRC Press , 2007.
2	D. Johnson, "Process Control Instrumentation Technology", John Wiley and Sons.
3	Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.

Reference (s)

1	Andrzej M. Pawlak Sensors and Actuators in Mechatronics Design and Applications, 2006
2	D.Patranabis, "Sensors and Transducers", TMH 2003.
3	Ian Sinclair, Sensors and Transducers, Elsevier, 3rd Edition, 2011
4	Ramon PallásAreny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, John Wiley and Sons,2000.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE017T	CONTROL SYSTEMS	3	0	0	3

Prerequisite Course (s)

Basics of Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Introduce the elements of the control system and their modeling using various Techniques.
2	Introduce methods for analyzing the time response, the frequency response and the stability of systems
3	Introduce the state variable analysis method.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Develop mathematical models of electrical and mechanical systems.
CO2	Determine the time response of the systems subjected to standard test signals.
CO3	Infer the concept of frequency domain specifications applied to systems.
CO4	Analyze the performance and stability of system through time domain and frequency domain approach.
CO5	Develop the lag, lead, lag-lead compensators for desired system performance.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	1	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	1	-	1	-	-	-	-	1	1
CO4	3	2	-	-	-	1	-	-	-	-	-	-	1	1
CO5	3	2	2	-	-	1	-	1	-	-	-	-	1	1
CO (Avg)	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	CONTROL SYSTEM MODELLING	9
Classification of control systems – definitions- open loop – closed loop systems - Electrical analogy of mechanical systems – Mathematical model of Mechanical and Electrical system - Transfer function - Block diagram reduction techniques – Signal flow graphs – Mason's gain formula.		
UNIT II	**TIME RESPONSE ANALYSIS**	**9**
Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Static Error Constants - Generalized Error Coefficients – Steady state error – Effects of P, PI, PID Controllers.		
UNIT III	**FREQUENCY RESPONSE ANALYSIS**	**9**
Frequency response – Bode plot – Polar plot – Nichols plot - Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.		
UNIT IV	**STABILITY ANALYSIS**	**9**
Characteristic equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus Techniques – Root locus plot for stability analysis - Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion		
UNIT V	**COMPENSATOR AND STATE SPACE ANALYSIS**	**9**
Design of lead, lag and lead – lag compensators – design using bode plots. Concepts of state – state variable and state models – state equation – state transition matrix – solution of state equation.		

Text Book (s)	
1	J. Nagrath and M. Gopal, 'Control Systems Engineering', 5th edition, New Age International Publishers, 2007.
2	Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.
Reference (s)	
1	K. Ogata, 'Modern Control Engineering', 5th edition, PHI, New Delhi, 2010
2	Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007
3	Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4	M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2012.
5	S. Palani,"Control System Engineering", 4th Edition , McGraw–Hill Education Pvt Ltd , 2012.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE018T	MEDICAL IMAGE PROCESSING	3	0	0	3

Prerequisite Course (s)

Digital Image Processing, Medical Electronics

Course Objective (s): The purpose of learning this course is to:

1	Study about various medical image acquisition methods.
2	Understand 2D and 3D image reconstruction techniques.
3	Gain sound knowledge about CT, MRI and Nuclear Imaging.
4	Realize the factors those, affect the quality of medical images.
5	Understand the concepts in various ultrasound and Future imaging techniques.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Acquire knowledge about Acquisition of Images and mathematical transforms required for image processing.
CO2	Perform image Reconstruction by Mathematical Preliminaries.
CO3	Learn the concepts of Neuro magnetic Imaging, Magnetic Resonance Imaging.
CO4	Understand the concepts of Fluoroscopy, CT, Image quality.
CO5	Understand the concepts of various ultrasound and Future imaging techniques.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO2	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO3	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO (Avg)	**2.4**	**2.4**	**1**	**1**	-	-	-	-	-	-	-	**1**	**2.4**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	ACQUISITION OF IMAGES	9
Introduction to Imaging Techniques- Single crystal scintillation camera – Principles of scintillation camera – multiple crystal scintillation camera –solid state camera – Rectilinear scanner –Emission computed Tomography.		
UNIT II	**MATHEMATICAL INITIALIZATIONS FOR IMAGE RECONSTRUCTION**	**9**
Image Reconstruction from Projections in Two dimensions –Mathematical Preliminaries for Two and Three dimensional Image Reconstructions –Radon Transform –Projection Theorem –central slice Theorem – Sinogram – Two Dimensional Projection Reconstruction –Three Dimensional Projection Reconstruction – Iterative Reconstruction Techniques.		
UNIT III	**MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY**	**9**
Fundamentals of magnetic resonance – overview – Pulse sequences – spatial encoding of magnetic resonance imaging signal – motion suppression techniques – contrast agents- tissue contrast in MRI – MR angiography, spectrography.		
UNIT IV	**FLUOROSCOPY, CT, IMAGE QUALITY**	**9**
Digital fluoroscopy – Automatic Brightness control- cinefluorography –Principles of computed Tomographic Imaging- Reconstruction algorithms- Scan motions – X –ray sources Influences of Images quality: Unsharpness – contrast- Image Noise.		
UNIT V	**ULTRA SOUND INSTRUMENTATION AND FUTURE DEVELOPMENTS IN MEDICALIMAGING**	**9**
Ultrasound: Presentation modes –Time required for obtaining images – System Components –Signal processing– Ultrasound Image Artifacts –Quality control - New Imaging technologies –Phase contrast X-ray Imaging – Information Management and Communication –Technology Assessment.		

Text Book (s)

1	William R. Hendee, E. Russell Ritenour, "Medical Imaging Physics", A John Wiley & sons, Inc., Publication, Fourth Edition 2002.
2	Z.H. Cho., J-oie, P. Jones and Manbir Singh, " Foundations of Medical Imaging", John Wiley and sons Inc.

Reference (s)

1	Avinash C. Kak, Malcolm Shaney, "Principles of Computerized Tomographic Imaging", IEEE Press, Newyork-1998.
2	Steve Webb, "The Physics of Medical Imaging, Taylor & Francis", New York.1988.
3	D.N.Chesney and M.O.Chesney, "Radio graphic imaging", CBS Publications, New Delhi, 1987.

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Regulation 2018		Semester__	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE019T	PCB DESIGN ENGINEERING	3	0	0	3

Prerequisite Course (s)

Basic Electrical and Electronics Engineering, Analog Electronics, Digital Electronics

Course Objective (s): The purpose of learning this course is to:

1	Understand the basics requirement of PCB types, electronic packages and flow of PCB design.
2	Construct the layout design and assemble the components as per IPC standard.
3	Design in CAE and CAD Tools.
4	Calculate the current calculations in design to improve the performance.
5	Understand the manufacturing & Advanced Techniques in PCB.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate Basics of Printed circuit board design engineering
CO2	Examine the PCB design process, rules and routing
CO3	Design PCB design parameters using CAE tools
CO4	Evaluate the electrical parameters and design of PCB
CO5	Develop the knowledge on Manufacturing and advanced PCB techniques

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	_	_	_	_	_	_	2	2	3
CO2	3	3	3	2	2	1	_	_	2	_	_	2	3	3
CO3	3	3	3	2	2	_	_	_	2	_	_	2	3	3
CO4	3	3	3	2	2	1	_	_	2	_	_	2	3	3
CO5	3	2	2	2	2	2	_	_	_	_	_	2	2	3
CO (Avg)	3	2.6	2.8	2	2	1.3	_	_	2	_		2	2.6	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	BASIS OF PRINTED CIRCUIT BOARD DESIGN ENGINEERING	9

Printed Circuit Boards history & evolution- Technology trends- Physical characteristics of the PCB-vias concept Classes of PCB designs- Types of Printed Circuit Boards- Types of packages for electronic circuits-Concepts of Printed Circuit Board Design & Manufacturing- System specification- System block diagram- Partitioning system into PCBs- Determining PCB size- Building component libraries.

UNIT II	PCB DESIGN PROCESS	9

Creating the schematic- Mechanical design parameters and enclosures- Mechanical aspects- Stack up build- Design flow formulation- Placing components on PCBs- Constraints set up-Power rules- Mixed Signal design rules- High-Speed rules- Consideration on timing & transmission lines effects- Routing PCB- Checking routed results - Generating manufacturing files – archiving design.

UNIT III	DESIGN TOOLS AND DESIGN PARAMETERS	9

Setting up the PCB design process in CAE tools- Library, Schematic – CAD tools - Mechanical, Placement, Setting Constraint, Auto Routing, Manual Routing, Post Root Task, Output Generation. Design Rules Setting to compliance with Design & Manufacturability- Physical Rules, Spacing Rules, Electrical Rules. EDA tools.

UNIT IV	DESIGN PERFORMANCE	9

Electrical Design Parameters- Current Calculations, Voltage Calculation, Impedance Calculations. Electrical Design Performance-Signal Integrity, Power Integrity, Thermal Management.

UNIT V	MANUFACTURING AND ADVANCED PCB TECHNIQUES	9

Manufacturing related documentation- Planning for Fabrication & Assembly- Fabrication process- Assembly process Hand Soldering process, Wave soldering, Reflow soldering - Bare Board testing methods - Introduction to New Technologies-HDI technology, Flexi Rigid Boards, Embedded Actives and Passives.

Text Book (s)

1	Clyde F. Coombs, "Printed Circuits Handbook", Sixth Edition, The McGraw-Hill Companies, 2008.
2	Sd Mehta, "Electronic Product Design Vol I Basic Of PCB Design", S Chand & Company Pvt Ltd, 2011.

Reference (s)

1	John H. Lau, "Microvias: For Low Cost, High Density Interconnects: Conventional Printed Circuit Board Technologies", McGraw-Hill Professional, 2001.
2	R. Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly", McGraw-Hill Electronic Engineering, August 2005.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE020T	Industrial Automation	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation, Control Systems

Course Objective (s):

The purpose of learning this course is to:

1	Understand the fundamentals of Programmable Logic Controller (PLC)
2	Learn and understand the concepts of Addressing and Control
3	Design basic programming in PLC
4	Know about the basic in SCADA and DCS systems
5	Learn about the Industrial IOT

Course Outcome (s) (COs):

At the end of the course students should be able to:

CO1	Construct architecture of PLC and develop ladder logic programs for logic gates implementation.
CO2	Describe the concepts of Addressing and Control
CO3	Develop the Knowledge on programming concepts of PLC and develop programs for real time applications
CO4	Explore the function of SCADA and DCS
CO5	Categorize the applying knowledge on Industrial IOT

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	3	3	2	2	1	1	-	-	-	-	1	3	1
CO4	3	2	1	1	1	1	-	-	-	-	-	-	3	-
CO5	3	3	2	1	1	1	1	-	-	1	-	1	3	1
CO (Avg)	3.00	2.60	2.00	1.30	1.30	1	1	-	-	1.00	-	2.00	2.80	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	PROGRAMMABLE LOGIC CONTROLLER	9
Evolution of PLC's -Components of PLC - Architecture of PLC–Discrete and Analog I/O modules - Programming languages –-Ladder diagram -Programming timers and counters		
UNIT II	**ADDRESSING AND CONTROL**	**9**
Analog addressing, continuous process monitoring and control - Types of controllers -ON/OFF, Proportional, Derivative, Integral and PID controllers. Timer instructions, On delay timer, Off delay timer - Counter instructions, up counter, down counter		
UNIT III	**PLC PROGRAMMING**	**9**
Instructions in PLC - program control instructions, math instructions, sequencer instructions, Basic programs using switches and coils, Concept of latch, blinking and process repeat.		
UNIT IV	**DCS AND SCADA**	**9**
Evolution - DCS - Architectures – Comparison – Local control unit – Process interfacing issues. SCADA: Remote terminal units, Master station, Communication architectures.		
UNIT V	**INDUSTRIAL IOT**	**9**
AS interface - Devicenet- Industrial Ethernet - Introduction to OLE for process control - WSN technology - IOT- IIOT.		

Text Book (s)

1	F.D.Petruzella, Programmable Logic Controllers,Tata Mc-Graw Hill,Third edition, 2010
2	T.A. Hughes, "Programmable Logic Controllers: Resources for Measurements and Control Series", Fourth edition, ISA Press, 2005.
3	Alasdair Gilchrist," Industry 4.0:The Industrial Internet of Things, Apress, 2016.

Reference (s)

1	G.K.McMillan, "Process/Industrial Instrument and Controls Handbook", Fifth Edition, McGraw-Hill handbook, New York, 1999.
2	J.Berge, "Field Buses for Process Control: Engineering, Operation, and Maintenance",ISA Press, 2004.
3	Hughes .T, "Programmable Logic Controllers", ISA Press, 1989.

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Regulation 2018		Semester __	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE021J	FIBER OPTIC COMMUNICATION	3	0	2	4

Prerequisite Course (s)

Analog communication, Digital communication

Course Objective (s): The purpose of learning this course is to:

1	Study about the various optical fiber modes, configuration of optical fibers
2	Analyze the signal degradation factors coupled with optical fiber
3	Learn the various optical source and photonic crystal in the optical communication system
4	Examine the optical receivers and their uses
5	Discuss about digital transmission and its related parameters on system performance

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Realize basic elements in optical fibers, different modes and configurations.
CO2	Summarize the signal degradation factors in optical fibers
CO3	List the characteristics of LED and Laser diodes structures
CO4	Discuss the error sources in optical detectors
CO5	Describe the different types of digital transmission systems

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	-	3	2
CO3	3	2	1	-	1	-	-	-	-	-	-	-	3	2
CO4	3	2	1	1	1	-	-	-	-	-	-	-	3	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	2
CO (Avg)	3	2	1	1	1	-	-	-	-	1	-	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO OPTICAL FIBERS	9

Elements of an Optical fiber Transmission link - Ray theory transmission - Total internal reflection, Acceptance angle, Numerical Aperture, Optical Fiber Modes and Configurations- skew rays-Mode theory of circular wave guide - Overview of Modes, Key Modal Concepts-Linearly Polarized Modes -Single Mode Fibers, Graded Index fiber structure

UNIT II	SIGNAL DEGRADATION IN OPTICAL FIBERS	9

Attenuation -Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination-Group Delay-Material Dispersion, Wave guide Dispersion, ISI , Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling Design Optimization of SM fibers, RI profile and cut-off wavelength-Mode filed Diameter

UNIT III	OPTICAL SOURCES AND PHOTONIC CRYSTAL	9

LED's- Modulation Of LED, Quantum efficiency and LED power, LASER Diodes: Modulation of LASER diodes - Rate equations -External Quantum efficiency -Temperature effects -Power Launching and Coupling: Source to fiber power launching - Lensing Schemes for Coupling improvement - Fiber Optical Sources and Coupling - Fibre- to-Fibre joints - Fiber splicing. Principle of Photonic crystal, Guidance mechanism: Index guiding PCF, Photonic band gap PCF, All solid photonic Bandgap PCF, Hybrid PCF, Applications Of PCF in sensing.

UNIT IV	FIBER OPTICAL RECEIVERS	9

PIN Photo detector -Schottky -Barrier Photodiodes -Avalanche Photodiodes - Photo detector noise -Detector response time - Avalanche multiplication of Noise-Temperature effects on Photo Detectors-Phototransistors -Fundamental Receiver operation-preamplifiers-Error Sources-Receiver configuration -Probability of error-Quantum limit

UNIT V	DIGITAL TRANSMISSION SYSTEMS	9

Point to point link systems considerations -Link Power budget-Rise time budget-Noise effects on system performance - Operational principles of Wavelength division multiplexing (WDM)–Solitons -Erbium doped fiber Amplifier (EDFA's)-Basic on concepts of SONET/SDH Network-application of OFC-CATV.

LIST OF EXPERIMENTS	15

1. Measurement of Numerical Aperture and Coupling efficiency (Angular and Lateral) in Optical Fiber.
2. Attenuation losses and Bending losses in single mode optical fiber.
3. DC Characteristics of LED Diode.
4. DC Characteristics of LASER Diode.
5. DC Characteristics of PIN Diode.
6. Study of Data Communication using Single Mode Fiber Optic System.

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7. Pulse Width Modulation and Demodulation using fiber optic System.

8. Transmission of different wavelengths using WDM and De-Multiplexing.

9. Transmission and Reception of TDM signals using fiber optic System.

10. Eye pattern measurement.

Text Book (s)	
1	Gerd Keiser,"Optical Fiber Communication",Fifth Edition, Tata Mc Graw Hill, 2007
2	John M. Senior,"Introduction to Optical Fiber Communications", Pearson / Prentice Hall
Reference (s)	
1	Palais,"Fiber optic communications", Fifth Edition, Pearson, 2005
2	Agarwal.G.P, "Fiber Optic Communication systems", Second Edition, John Wiley & Sons, NY, 1997.
3	Harry J.R Dutton, "Understanding Optical Communications", IBM Corporation, International Technical Support Organization.
4	J.Gower, "Optical Communication System ", Prentice Hall of India, 2001.

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Regulation 2018		Semester__	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE022T	ROBOTICS & AUTOMATION	3	0	0	3

Prerequisite Course (s)

Control Systems

Course Objective (s): The purpose of learning this course is to:

1	Understand the basic concepts of Robots and various Grippers.
2	Learn the basic knowledge in power sources and types of sensors.
3	Learn about the transformations, Forward and Inverse Kinematics of Robots.
4	Study the differential motion techniques and Velocities.
5	Learn about various motion planning techniques and the trajectory Planning.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Gain basic knowledge about robots and its associated grippers.
CO2	Examine different sensors and the choice of different sources of drives.
CO3	Understanding the basics of Kinematics of Robots.
CO4	Describe the Differential concepts of motion and velocities
CO5	Explain Trajectory planning techniques along with the control architectures adopted for robot motion planning.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	-	-	-	-	1	-	2	-
CO2	3	-	-	-	-	1	-	-	-	-	1	-	2	-
CO3	3	1	-	-	-	1	-	1	-	-	1	-	2	-
CO4	3	1	-	-	-	1	-	1	-	-	1	-	2	1
CO5	3	1	-	-	-	1	-	1	-	-	1	-	2	1
CO (Avg)	**3**	**1**	-	-	-	**1**	-	**1**	-	-	**1**	-	**2**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	BASIC CONCEPTS	9
History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical Grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.		
UNIT II	**POWER SOURCES AND SENSORS**	**9**
Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors- inertial, thermal, chemical, biosensor, other common sensors		
UNIT III	**KINEMATICS OF ROBOTS**	**9**
Robots as Mechanisms-Matrix Representation-Representation of Transformations-Inverse of Transformation Matrices-Forward and Inverse Kinematics of Robots-Denavit Hartenberg representation of Forward Kinematic Equations of Robots-Degeneracy and Dexterity-		
UNIT IV	**DIFFERENTIAL MOTIONS AND VELOCITIES**	**9**
Differential relationships – Jacobian – Differential Motions of a frame – Interpretation of the differential change – Calculation of the Jacobians – Inverse Jacobians –Dynamic analysis and Forces – Lagrangian Mechanics-Effective Moments of Inertia-Dynamic Equations for Multiple-DOF Robots-Static Force Analysis of Robots		
UNIT V	**TRAJECTORY PLANNING AND MOTION CONTROL**	**9**
Basics of Trajectory planning – Joint Space Trajectory Planning – Cartesian Space Trajectories -Motion Control system basic components – System Dynamics -Inverse Laplace transform – Block diagram algebra – Characteristics of first order and second order functions.		

Text Book (s)	
1	Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
2	Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1999.
Reference (s)	
1	Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore,2nd Edition2012.
2	Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011
3	Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988
4	Asfahl C.R., Robots and manufacturing Automation, John Wiley, 2nd edition 2014.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE023T	WIRELESS NETWORKS	3	0	0	3

Prerequisite Course (s)

Computer Networks

Course Objective (s): The purpose of learning this course is to:

1	Study about Wireless networks, protocol stack and standards.
2	Study about Mobile application Protocols and standards.
3	Study about Mobile IP Standards standards.
4	Study about Transport layer.
5	Study about evolution of 4G Networks, its architecture and applications.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concepts of WLANs
CO2	Discussed about the WIRELESS WANs
CO3	Explain the Parameters of Mobile Network Layer
CO4	Summarize the various techniques of Transport layers
CO5	Discuss the applications of 4G Networks

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	1	-	-	-	2	-	1	3	2
CO2	3	2	2	1	-	1	-	-	-	2	-	1	3	2
CO3	3	3	3	2	1	1	-	-	-	2	1	2	3	2
CO4	3	3	3	-	1	-	-	-	-	2	1	1	3	2
CO5	3	3	3	-	1	1	-	-	-	1	2	2	3	2
CO (Avg)	3	2.6	2.6	1.5	1.25	1	-	-	-	1.8	1.33	1.4	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	WIRELESS LOCAL AREA NETWORKS	9
Introduction to Wireless LANs – WLAN Equipment, Topologies, Technologies, IEEE 802.11 WLAN –Architecture and Services, Physical Layer- MAC Sub Layer –MAC Management Sub Layer, Other IEEE 802.11 Standards, HIPERLAN, WiMAX.		
UNIT II	**WIRELESS WANS**	**9**
GSM and TDMA technology: Introduction-Mechanism to support a mobile Environment-Communications in the infrastructure, CDMA Technology, IS-95, IMT -2000, Mobile Data Networks: Data Oriented CDPD Networks-GPRS and Higher Data Rates-Mobile application Protocol.		
UNIT III	**MOBILE NETWORK LAYER**	**9**
Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, Optimization-IPV6, mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.		
UNIT IV	**MOBILE TRANSPORT LAYER**	**9**
TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Transaction oriented TCP – TCP over 2.5/3G wireless networks, Performance enhancing proxies.		
UNIT V	**4G NETWORKS**	**9**
Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio, Software defined Radio (SDR).		

Text Book (s)

1.	Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", 1st Edition, Pearson Education Asia, 2002
2.	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,III,IV)

Reference (s)

1.	Vijay K. Garg, "Wireless Communications and Networking", 1 st Edition, Morgan Kaufmann Publishers, 2007. .(Unit V)
2.	Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE024T	OPTICAL NETWORKS	3	0	0	3

Prerequisite Course (s)

Fiber Optic Communication

Course Objective (s): The purpose of learning this course is to:

1	Make students familiar with fundamentals of Optical networks
2	Choose system (SONET,/MDH) according to the complexity and select WDM routing architecture
3	Identify the wavelength routing networks
4	Identify the Network design and management

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify with various optical system components.
CO2	Realize the concept of optical network architecture.
CO3	Explain the basics of wavelength routing techniques
CO4	Analyze the photonic packet switching and access networks
CO5	Gain knowledge of network design management.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	1
CO2	3	3	1	1	-	-	-	-	-	-	-	1	3	1
CO3	3	3	1	1	1	-	-	-	-	-	1	-	3	1
CO4	3	3	1	1	-	-	-	-	-	-	1	-	3	1
CO5	2	3	1	-	1	-	-	-	-	-	-	-	3	-
CO (Avg)	**2.8**	**3**	**1**	**1**	**1**	-	-	-	-	-	**1**	-	**3**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	OPTICAL SYSTEM COMPONENTS	9
Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters		
UNIT II	**OPTICAL NETWORK ARCHITECTURES**	**9**
Introduction to Optical Networks; SONET / SDH, Metropoliton-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.		
UNIT III	**WAVELENGTH ROUTING NETWORKS**	**9**
The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.		
UNIT IV	**PACKET SWITCHING AND ACCESS NETWORKS**	**9**
Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks		
UNIT V	**NETWORK DESIGN AND MANAGEMENT**	**9**
Transmission System Engineering – System model, Power penalty – transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.		

Text Book (s)	
1	Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2004.
Reference (s)	
1	C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002.
2	P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE025T	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

Prerequisite Course (s)

Computer Networks

Course Objective (s): The purpose of learning this course is to:

1	Describe the fundamentals of cryptography
2	Discuss the cryptosystems
3	Discuss the need of encryption
4	Explain the network security and architecture
5	Analyze the system security

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Recognize the basics of symmetric ciphers
CO2	Differentiate on advanced symmetric ciphers
CO3	Interpret the encryption and hash function
CO4	Distinguish the security at different layers.
CO5	Relates the system security, threads and firewalls

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	1	2	1
CO2	3	2	2	2	-	-	-	-	-	1	-	-	2	1
CO3	3	3	3	2					-	-	-	-	2	1
CO4	2	3	3	2	-	-	-	-	-	1	-	1	2	1
CO5	3	2	2	3	-	-	-	-	-	-	-	-	2	1
CO (Avg)	2.8	2.6	2.6	2.2	-	-	-	-	-	1	-	1	2	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	BASIC SYMMETRIC CIPHERS	9

OSI security Architecture- Model for network Security, Classical Encryption Techniques- Symmetric Cipher Model- Substitution Techniques-Transposition Techniques- Steganography, Block Ciphers and Data Encryption Standard- Block Cipher Principles-Data Encryption Standard- Strength of DES-Block Cipher Design Principles

UNIT II	ADVANCED SYMMETRIC CIPHERS	9

AES Cipher- Multiple Encryption-Triple DES- Block Cipher Modes of Operation -Stream Ciphers and RC4, Confidentiality using Symmetric Encryption-Placement of Encryption Function, Traffic Confidentiality, Key Distribution and Random Number Generation

UNIT III	PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS	9

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm, Key Management - Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography, Message Authentication and Hash Functions- Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MAC algorithms-Secure Hash Algorithm- HMAC, Digital Signatures, Digital Signature Standards.

UNIT IV	NETWORK SECURITY AND WEB SECURITY	9

Authentication Applications- Kerberos, X.509- Authentication Service, Electronic Mail Security - Pretty Good Privacy - S/MIME, IP Security- IP Security Overview - IP Security.

Architecture - Authentication Header - Encapsulating Security Payload, Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction

UNIT V	SYSTEM SECURITY	9

Intruders- Intruder Detection- Password Management, Malicious Software- Virus and Related Threats - Virus Counter Measures, Firewalls- Firewall Design Principles, Cyber security in Telecommunication industry

Text Book (s)

1	William Stallings, "Cryptography and Network Security", fourth edition, Prentice Hall of India,New Delhi ,2006
2	Behrouz A. Fourcuzan , " Cryptography and Network security" Tata McGraw- Hill,2008.

Reference (s)

1	William Stallings, "Network Security Essentials", 2 ed. Prentice Hall of India, New Delhi, 2004.
2	Douglas R.Stinson, "Cryptography: Theory and Practice", CRC Press Series on Discrete Mathematics and its Applications, 1995.
3	David M. Durton, "Elementary Number Theory", Tata Mcgraw Hill, Sixth Edition, 2009.
4	Charlie Kaufmann, Radia Perlman, Mike Speciner, "Network Security", Second Edition, Prentice Hall, 2002

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE026T	HIGH PERFORMANCE COMMUNICATION NETWORKS	3	0	0	3

Prerequisite Course (s)

Computer Networks, High Speed Networks

Course Objective (s): The purpose of learning this course is to:

1	Understand the history of Communication Networks and LAN Switching Technologies
2	Study basic Concept of Network services and architectures
3	Known the Internet Concepts and TCP/IP Protocols
4	Perform the Packet Switching Architectures
5	Understand the Control of Networks

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Gain about the LAN Switching Technologies
CO2	Make services and Layered architectures
CO3	Carry out the Internet and TCP/IP Protocols
CO4	Gained about the Packet Switching Architectures
CO5	Understand about the knowledge Control of network

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	1	-	-	1	1	-	2	3	1
CO2	3	3	3	1	1	-	-	-	1	1	-	2	2	2
CO3	3	2	1	1	1	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	1	-	-	-	-	-	1	1	-	2	3	2
CO (Avg)	3	2.40	2	1	1.33	1	-	-	1	1	-	2	2.6	1.8

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	HISTORY OF COMMUNICATION NETWORKS AND LAN SWITCHING TECHNOLOGY	9
History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, and Wireless. Switch Forwarding Techniques, Switch Path Control, LAN Switching, Cut through Forwarding, Store and forward.		
UNIT II	**NETWORK SERVICES AND LAYERED ARCHITECTURE**	**9**
Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.		
UNIT III	**INTERNET AND TCP/IP NETWORKS**	**9**
Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.		
UNIT IV	**PACKET SWITCHING ARCHITECTURES**	**9**
Architectures of Internet Switches and Routers- Buffer less and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.		
UNIT V	**CONTROL OF NETWORKS**	**9**
Control of networks, Objectives and methods of control, Circuit switched networks, Datagram Networks Network economics, Derived demand for network services, ISPs, subscriber demand model, Empirical model.		

Text Book (s)	
1	Jean Walrand, Pravin Varaiya High Performance Comunication Networks,Second Edition,Morgan Kaufamn Publishers
2	Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007
Reference (s)	
1	Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet", Fifth Edition, Pearson Education, 2012.
2	Christopher Y Metz, Switching protocols & Architectures, McGraw Hill Professional Publishing, New York, 1998
3	Walrand .J. Varatya, "High Performance Communication Network", Morgan Kaufmann –Harcourt Asia Pvt. Ltd., 2ndEdition, 2000.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE027T	LORA WAN	3	0	0	3

Prerequisite Course (s)

Computer Networks

Course Objective (s): The purpose of learning this course is:

1	Understand the Basics of LoRaWAN.
2	Applying the concepts of IOT in LoRa and LoRaWAN.
3	Analyzing the Long Range & Low Power Networks for the Internet of Things and The LoRaWAN Protocol.
4	Understanding the concepts of Formal security analysis of LoRaWAN.
5	Analyze the Testing and measurements of LORA.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Study and Understanding about IoT Networks with LoRaWAN.
CO2	Apply IoT concepts in LoRa and MQTT protocol.
CO3	Analyze the Long Range & Low Power Networks using LoRWAN Protocol.
CO4	Understand the Formal security analysis of LoRaWAN .
CO5	Analyze the testing of LORA.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	3	2	3	-	3	-	3	3
CO2	3	2	2	-	3	-	3	2	3	-	3	-	3	3
CO3	3	2	2	-	3	-	3	2	3	-	3	-	3	3
CO4	3	2	2	-	3	-	3	2	3	-	3	-	3	3
CO5	3	2	2	-	3	-	3	2	3	-	3	-	3	3
CO(Avg)	3	2	2	-	3	-	3	2	3	-	3	-	3	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	IOT NETWORKS WITH LORAWAN	9

What is LoRa(WAN) - Over The Air - Hardware Components - Software libraries for LoRa and LoRaWAN -LoRa Examples for Arduino - LoRa Examples for ARM mbed OS, SemtechLoRaMAC - Low Power Optimization - Improving the operating range.

UNIT II	IOT IN LORA AND LORAWAN	9

Introduction to LoRa and LoRaWAN – Connecting with IOT servers using MQTT – Building a LoRa Gateway – obtaining and preparing hardware- connecting with IOT servers using RESTful API.

UNIT III	LONG RANGE & LOW POWER NETWORKS FOR THE INTERNET OF THINGS	9

Introduction to Related Work - IEEE802.15.4 - Bluetooth/LE- IEEE 802.11 ah- Sigfox- LoRa Overview - The LoRa Physical Layer - The LoRaWAN Protocol - LoRaWAN Analysis.

UNIT IV	FORMAL SECURITY ANALYSIS OF LORAWAN	9

Introduction-LoRaWAN –LoRaWANv1.0 – LoRaWANv1.1 -Known attacks to LoRa WAN - Security protocol analysis and Scyther - Security verification results - Open security challenges with LoRa WAN v1.1 - Cryptographic primitives - Key preloading - Infrastructure trust.

UNIT V	TESTING ANALYSIS OF LORA	9

Introduction - Materials and methods - Low power air velocity measurement -Radio performance criteria- Applied radio modules - Air velocity measurements.

Text Book (s)

1	"IoT Networks with LoRaWAN" Authors by Bernd Wiegmann.
2	"Beginning LoRa Radio Networks with Arduino - Build Long Range, Low Power Wireless IoT Networks" Authors by Seneviratne, Pradeeka.

Reference (s)

1	"Formal security analysis of LoRaWAN" Author by Mohamed Eldefrawy, Ismail Butun, Nuno Pereira and MikaeGidlund in Elsevier Journal - Computer Networks , Volume 148, 15 January 2019, Pages 328-339.
2	"A Study of LoRa: Long Range & Low Power Networks for the Internet of Things" Authors by AloÿsAugustin,Jiazi Yi , Thomas Clausen and William Mark Townsley.

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Regulation 2018		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE028T	ADHOC AND SENSOR NETWORKS	3	0	0	3

Prerequisite Course (s)

Computer Networks

Course Objective (s): The purpose of learning this course is to:

1	Know the challenges of emerging trends in adhoc network
2	Study the MAC, Routing protocols for adhoc networks
3	Design and develop Routing algorithms
4	Obtain the concept of networking sensors and architecture
5	Know the sensor networking database and tools

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze the MAC issues in Ad hoc networks
CO2	Describe the operation of the routing protocols
CO3	Discuss about QoS and energy management in Ad hoc networks
CO4	Understand the concept of networking sensors and architecture
CO5	Summarize the sensor networking database and tools

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	-	1	-	-	-	-	-	-	1	2	1
CO (Avg)	**2.2**	**2**	**1**	-	**1**	-	-	-	-	-	-	**1**	**2**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	MAC PROTOCOLS	9
Cellular and Ad Hoc wireless networks – issues in adhoc wireless networks - issues in designing a MAC Protocol – design goals – contention-based protocols – contention-based protocols with reservation mechanism - contention based protocols with scheduling mechanism – MAC protocols that use directional antennas – multichannel MAC protocol		
UNIT II	**ROUTING PROTOCOLS**	**9**
Issues in designing a routing protocol – Routing protocols: Table driven – On-demand – hybrid – hierarchical – power aware – Routing protocols with efficient flooding mechanisms		
UNIT III	**QOS AND ENERGY MANAGEMENT**	**9**
Classifications of QoS solutions – MAC layer solutions – Network layer solutions – QoS frameworks – Need for energy management – classification of energy management schemes – battery management schemes – transmission power management schemes – system power management schemes		
UNIT IV	**NETWORKING SENSORS AND ARCHITECTURE**	**9**
Unique Constraints and Challenges - Canonical Problem: Localization and Tracking : A Tracking Scenario - Problem Formulation- Distributed Representation and Inference of States -Tracking Multiple Objects-Sensor Models - Networking Sensors: Medium Access Control-Geographic, Energy-Aware Routing-Attribute based Routing - Infrastructure Establishment: Topology Control-Clustering-Time Synchronization-Localization and Localization Services		
UNIT V	**SENSOR NETWORKING DATABASE AND TOOLS**	**9**
Sensor Database Challenges-Querying the Physical Environment-Query Interfaces-High-Level Database Organization-In-Network Aggregation-Data-Centric Storage-Temporal Data- Sensor Node Hardware-Sensor Network Programming Challenges-Node-Level Software Platforms-Node-Level Simulators-Programming Beyond Individual Nodes: State-Centric Programming		

Text Book (s)	
1	C.Siva Ram Murthy and B.S. Manoj, —Ad Hoc Wireless Networks – Architectures and Protocols‖, Pearson Education, 2004
2	Feng Zhao and Leonidas Guibas, —Wireless Sensor Networks, Morgan Kaufman Publishers, 2004.
Reference (s)	
1	C.K.Toh, —Ad Hoc Mobile Wireless Networks, Pearson Education, 2002.
2	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE029T	SATELLITE COMMUNICATION	3	0	0	3

Prerequisite Course (s)

Digital Communication, Antennas and Wave Propagation

Course Objective (s): The purpose of learning this course is to:

1	Know the basics of satellite communication.
2	Understand the concepts of orbital mechanics, multiple access techniques and space links.
3	Gain knowledge on spacecraft subsystems, earth stations and satellite platform applications.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify the spacecraft sub system used in satellite communication
CO2	Analyze various subsystems of spacecraft
CO3	Design and analyze the characteristics satellite links
CO4	Analyze the various medium access techniques
CO5	Apply different types of broadcasting/military applications and multimedia services

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	2
CO2	3	2	2	-	-	-	-	-	1	-	-	-	3	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	1	2	2	-	-	1	-	-	-	-	-	3	2
CO5	3	1	1	-	-	1	-	-	1	-	-	1	2	2
CO (Avg)	3	1.6	1.8	2	-	1	1	-	1	-	-	1	2.8	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ORBITAL MECHANICS	9
Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles. Spectrum allocations for satellite systems.		
UNIT II	**SPACECRAFT SUB SYSTEMS AND EARTH STATION**	**9**
Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.		
UNIT III	**SPACE LINKS**	**9**
The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersal, propagation characteristics of fixed and mobile satellite links.		
UNIT IV	**MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS**	**9**
Single access vs. multiple accesses (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques. Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures. Hybrid satellite-terrestrial networks.		
UNIT V	**SERVICES AND APPLICATIONS**	**9**
Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM. GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity.		

Text Book (s)

1	Dennis Roddy, "Satellite Communications", Third Edition, Mc Graw Hill International Editions,2001.
2	Bruce R.Elbert, "The Satellite Communication Applications Hand Book, Artech House Boston, 2003.

Reference (s)

1	Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, Newyork, 1990
2	Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,"Satellite Communication Systems Engineering", II Edition, Prentice Hall, New Jersey, 1993.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE030T	RADAR AND NAVIGATIONAL AIDS	3	0	0	3

Prerequisite Course (s)

Digital Communication, Antenna and wave Propagation, Electromagnetic wave guides.

Course Objective (s): The purpose of learning this course is to:

1	Apply the Doppler principle to radars and hence detect moving targets, cluster, to understand tracking radars.
2	Refresh the principles of antennas and propagation as related to radars and to study of Radar transmitters and receivers.
3	Aware of principles of navigation, landing aids.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate the principles of radar
CO2	Examine the operation of Moving Target Indicator and pulse Doppler radar
CO3	Demonstrate the building blocks of Radar transceiver
CO4	Explain concepts of navigational system and Compare different navigation systems
CO5	Discuss instrument landing system and distance measuring equipment

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	1	1	1	1	2	2
CO2	3	3	2	1	-	-	-	1	-	1	1	1	2	2
CO3	3	3	3	1	-	-	-	1	-	1	1	1	3	2
CO4	3	2	2	1	-	-	-	1	-	1	1	1	2	2
CO5	3	2	2	1	-	-	-	1	1	1	1	1	2	2
CO (Avg)	3	2.6	2.4	1	-	-	-	1	1	1	1	1	2.2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO RADAR	9

RADAR principle, RADAR Block Diagram, Radar frequencies, Radar equation, Detection of signals in noise, Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power- Pulse Repetition Frequency- Antenna Parameters - System losses.

UNIT II	MTI,PULSE DOPPLER RADAR AND TRACKING RADAR	9

Introduction to Doppler and Moving Target Indicator (MTI) Radar, Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Digital MTI Processing , Moving Target Detector, Limitations to MTI Performance, MTI from a Moving Platform. Pulse Doppler Radar, Tracking with Radar, Monopulse Tracking, Conical Scan and Sequential Lobing,Limitations to Tracking Accuracy, Comparison of Trackers, Tracking with Surveillance Radars (ADT).

UNIT III	DETECTION OF SIGNAL	9

Introduction – Detection Criteria, Automatic Detector - Constant False Alarm Rate Receivers - Radar operator – Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation, Radar Antenna – Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters – Frequency Scan Arrays. Radar Transmitters -Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron Radar Receivers - Receiver noise Figure -Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV	NAVIGATIONAL SYSTEMS	9

Four Methods of Navigation ,Radio Direction Finding - Loop Antenna - Loop Input Circuits - Aural Null Direction Finder -Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies -Automatic Direction Finders - Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR -Hyperbolic Systems of Navigation (Loran and Decca) – Loran A Equipment - Range and precision of Standard Loran – Loran C - Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - Omega System

UNIT V	SATELLITE NAVIGATION SYSTEM	9

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System (ILS) -Ground Controlled Approach (GCA) System - Microwave Landing System (MLS) Doppler Navigation - Doppler Effect -Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems, Inertial Navigation - Principles of Operation - Navigation Over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization -Strapped-Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System(GPS).

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Text Book (s)	
1	Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
2	N.S.Nagaraja, —Elements of Electronic Navigation Systems‖, 2nd Edition, Tata McGraw-Hill, 2000.
Reference (s)	
1.	Albert Helfrick.D,‖, Principles of Avionics‖, Avionics communications Inc,2004.
2.	Peyton Z. Peebles:, "Radar Principles", John wiley, 2004.
3.	J.C Toomay, " Principles of Radar", 2nd Edition –Prentice Hall India, 2004.

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE031T	SPACE TIME WIRELESS COMMUNICATION	3	0	0	3

Prerequisite Course (s)

Digital Signal Processing and Wireless Communication

Course Objective (s): The purpose of learning this course is to:

1	Acquire the knowledge on various modulation and coding schemes for space-time Wireless Communications.
2	Understand transmission and decoding techniques associated with Wireless Communications.
3	Understand multiple-antenna systems such as multiple-input multiple-output (MIMO) and Space-Time Codes.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe and categorize various wireless MIMO channel models.
CO2	Analyze the performance of various MIMO channel models.
CO3	Prioritize different spatial diversity techniques.
CO4	Explain various ST coding techniques and design optimum receivers for MIMO systems.
CO5	Analyze and evaluate advanced signal processing techniques for wireless communications.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	2
CO5	3	1	2	1	1	-	-	1	1	-	-	-	3	2
CO (Avg)	3	1.6	1.6	1	1	-	-	1	1	-	-	-	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION	9

Wireless channel, Scattering model in microcells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST multiuser and ST interference channels, ST channel estimation.

UNIT II	CAPACITY OF MULTIPLE ANTENNA CHANNELS AND SPATIAL DIVERSITY	9

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of rice an fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels, Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity ,Indirect transmit diversity, Diversity of a space-time-frequency selective fading channel.

UNIT III	MULTIPLE ANTENNA CODING AND RECEIVERS	9

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers (SISO,SIMO,MIMO),Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

UNIT IV	ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION	9

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMOOFDM, SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO-SS.MIMOMAC, MIMO-BC, Outage performance for MIMO-MU,MIMO-MU with OFDM,CDMA and multiple antennas.

UNIT V	ST CO-CHANNEL INTERFERENCE MITIGATION AND PERFORMANCE LIMITS IN MIMO CHANNELS	9

CCI characteristics, Signal models, CCI mitigation on receive for SIMO,CCI mitigating receivers for MIMO,CCI mitigation on transmit for MISO, Joint encoding and decoding, SS modulation, OFDM modulation, Interference diversity and multiple antennas, Error performance in fading channels, Signaling rate vs PER vs SNR, Spectral efficiency of ST doing/receiver techniques, System Design, Comments on capacity

Text Book (s)

1	Paulraj, Rohit Nabar, Dhananjay Gore., "Introduction to Space Time Wireless Communication Systems", Cambridge University Press, 2003.

Reference (s)

1	Sergio Verdu "Multi User Detection" Cambridge University Press, 1998.
2	Andre Viterbi "Principles of Spread Spectrum Techniques" Addison Wesley 1995.
3	Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University Press, 2005.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE032T	PATTERN RECOGNITION	3	0	0	3

Prerequisite Course (s)

Digital Image Processing

Course Objective (s): The purpose of learning this course is to:

1	Develop the mathematical tools required for the pattern recognition.
2	Study about feature extraction and structural pattern recognition.
3	Explore different classification models.
4	Understand Artificial neural network and Perceptron model.
5	Develop the applications based on pattern recognition.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the basic concepts in pattern recognition.
CO2	Summarize the various techniques involved in pattern recognition.
CO3	Categorize the various pattern recognition techniques into supervised and unsupervised.
CO4	Illustrate the artificial neural network-based pattern recognition.
CO5	Discuss the applications of pattern recognition in various applications.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	2	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1	2	1
CO5	3	3	2	1	-	-	-	-	-	-	-	2	3	1
CO (Avg)	**3**	**3**	**2**	**1**	-	-	-	-	-	-	-	**1.33**	**2.2**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION TO PATTERN RECOGNITION	9
Fundamental concepts and blocks of a typical pattern recognition system. Decision functions- role and types, pattern and weight space, properties and implementation of decision functions.		
UNIT II	**STRUCTURAL PATTERN IDENTIFICATION**	**9**
Feature identification, selection and extraction. Distance measures, clustering transformation and feature ordering, clustering in feature selection, feature selection through maximization and approximations.		
UNIT III	**UNSUPERVISED CLASSIFICATION**	**9**
Pattern classification by distance functions. Clusters and cluster seeking algorithms. Pattern classification by likelihood functions.Baye's classifier and performance measures.		
UNIT IV	**ARTIFICIAL NEURAL NETWORK**	**9**
Artificial neural network model, Neural network-based pattern associators, Feed forward networks and training by backpropagation- ART networks.		
UNIT V	**APPLICATIONS**	**9**
Applications of statistical and neural network – based pattern classifiers in speech recognition, image recognition and target recognition.		

Text Book (s)

1	J T Tou and R.C.Gonzalez, "Pattern Recognition Principles", 2nd Edition, Wesley Publication Company, London, 2010.
2	Robert J.Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley &Sons Inc., New York, 2007.

Reference (s)

1	P.A. Devijer & J. Kittler, "Pattern Recognition - A Statistical Approach", Prentice-Hall.
2	Christopher. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE033T	MULTIMEDIA COMPRESSION TECHNIQUES	3	0	0	3

Prerequisite Course (s)

Digital Image Processing

Course Objective (s): The purpose of learning this course is to:

1	Explain the need for Multimedia compression technique and the different types of data
2	Introduce methods for the generation of these codes and their decoding techniques
3	Study the basics of audio compression technique and the Vocoders
4	Have a detailed knowledge of compression and decompression techniques
5	Introduce the concepts of multimedia communication

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe various multimedia components
CO2	Describe Contour based compression and Motion estimation techniques
CO3	Describe audio compression and different coding techniques
CO4	Describe the video compression techniques and MPEG standards
CO5	Apply the compression concepts in multimedia communication.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	-	-	3	2	-	2	2	2
CO2	3	3	2	2	2	1	-	-	3	2	-	2	2	2
CO3	3	3	2	2	2	1	-	-	3	2	-	2	2	2
CO4	3	2	2	2	2	1	-	-	3	2	-	2	2	2
CO5	3	3	2	2	2	1	-	-	3	2	-	2	2	2
CO (Avg)	3	2.8	2	2	2	1	-	-	3	2	-	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	BASIC COMPRESSION TECHNIQUES	9
Approaches to Image Compression - Compression Techniques - Lossless Compression - Lossy Compression - Differential Lossless Compression - JPEG - JPEG-LS - JBIG - Wavelet-Based Compression – Multi resolution Decomposition- WSQ, Fingerprint Compression.		
UNIT II	**TEXT AND IMAGE COMPRESSION**	**9**
Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding –source encoding -text compression – static Huffman coding dynamic coding –arithmetic coding –Lempel Ziv-Welsh Compression-image compression.		
UNIT III	**MPEG AUDIO COMPRESSION**	**9**
Psychoacoustics - MPEG Audio - MPEG-7 Audio – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.		
UNIT IV	**VIDEO COMPRESSION**	**9**
Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video		
UNIT V	**MULTIMEDIA NETWORK COMMUNICATIONS AND APPLICATIONS**	**9**
Quality of Multimedia Data Transmission- Multimedia over IP - Multimedia over ATM Networks - Transport of MPEG-4 - Media~on-Demand (MOD) - C-BIRD - A Case Study.		

Text Book (s)	
1	Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2	David Salomon: Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
Reference (s)	
1	Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
2	Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
3	Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
4	Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
5	Watkinson,J : Compression in Video and Audio, Focal press,London.1995.
6	Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE034T	NANOTECHNOLOGY	3	0	0	3

Prerequisite Course (s)

Physics, Basic Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Provide the students with knowledge and the basic understanding of nanotechnology.
2	Enhance the knowledge of Nanoparticles
3	Know about Nanostructures and its effects
4	Study about Spectroscopy and its applications
5	Get an idea about Biological Materials, MEMS, NEMS

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Know what it takes to have a career in nanotechnology
CO2	Understand the need to increase Nanotechnology awareness
CO3	Understand the definition of Nanotechnology
CO4	Know the processing of Nano particles and Nano materials
CO5	Know the application of Nanotechnology and nano materials

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	1
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	3	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO (Avg)	3	2.6	2	1		-	-	-	-	-	-	1	2.8	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	SOLID STATE PHYSICS	9
Structure – Energy bands – Localized particles – Microscopy – Spectroscopy		
UNIT II	**NANO PARTICLES AND CARBON NANOSTRUCTURES**	**9**
Metal Nanoclusters – Semiconducting nanoparticles – Rare gas and molecular clusters – Methods of synthesis – Carbon molecules – Carbon clusters – Carbon nanotubes - Applications		
UNIT III	**NANOSTRUCTURED MATERIALS**	**9**
Solid disordered Nanostructures – Nanostructured crystals – Nanostructured ferromagnetism – Basics- Effects-Dynamics – Nanopore containment – Ferromagnets – Magneto resistance – Ferro fluids		
UNIT IV	**OPTICAL AND VIBRATIONAL SPECTROSCOPY**	**9**
Introduction – Infrared frequency range – Luminescence – Preparation of Nano structures – Size and Dimensionality effects – Single electron tunnelling - Applications		
UNIT V	**BIOLOGICAL MATERIALS**	**9**
Introduction - Biological building blocks – Nucleic acids – biological nanostructures – MEMS – NEMS – Molecular and Supramolecular Switches		

Text Book (s)

1	Poole C.P., and Owens J.F.,"Introduction to Nanotechnology" Wiley- Interscience, 2003.
2	Wilson M., Kannangara K., Smith G., Simmons M., and Raguse B.,"Nanotechnology: basic science and emerging technologies", Overseas Press, 2005.

Reference (s)

1	Ratner M.A., Ratner D.,"Nanotechnology: A Gentle Introduction to the Next Big Idea" ,First Edition,Prentice Hall PTR, 2002.
2	Billmeyer, F.W.,Textbook of Polymer Science ,John-Wiely & Sons(Asia) Pte. Ltd, 20034. Michael. K., Wolfgang. F,"Nanotechnology: An Introduction to Nanostructuring Techniques",Wiley-VCH,2007.
3	Paul. H Chu"Biomaterials fabrication and processing handbook "Taylor Francis group, 2008.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18ECE035T	MEMS	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation, Analog Integrated Circuits

Course Objective (s): The purpose of learning this course is to:

1	Understand the concepts of micro electromechanical devices
2	Understand the concepts of micro sensors and micro actuators
3	Understand the fabrication process of Microsystems
4	Study about design concepts of micro systems machining
5	Know the Design flow and applications.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate the operation of micro devices, micro systems and their applications.
CO2	Design the micro devices, micro systems using the MEMS fabrication process.
CO3	Analyse typical materials used for fabrication of micro systems.
CO4	Apply the principles of standard micro fabrication techniques in manufacturing
CO5	Analyse the challenges in the design and fabrication of Micro systems.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO2	3	2	1	1	-	-	-	-	-	-	-	-	3	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO (Avg)	3	2.4	1	1	-	-	-	-	-	-	-	1	2.4	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION TO MICROSYSTEMS	9
Overview of MEMS and Microsystems technology - Characteristics of MEMS materials - Laws of scaling - Multi-disciplinary nature of MEMS - Survey of materials central to micro engineering - Applications of MEMS in various industries - RF MEMS, BioMEMS, MOEMS, NEMS.		
UNIT II	**MICRO SENSORS AND ACTUATORS**	**9**
Working principle of Microsystems - micro actuation techniques - micro sensors - types - micro actuators - types – micro pump – micro motors – micro valves - micro grippers - micro accelerometers.		
UNIT III	**MICROSYSTEM FABRICATION PROCESS**	**9**
Substrates - single crystal silicon wafer formation - Photolithography - Ion implantation - Diffusion - Oxidation - CVD - Physical vapor deposition - Deposition epitaxy - etching process.		
UNIT IV	**MICROMACHINING**	**9**
Overview of micro manufacturing - Bulk micro manufacturing, Surface micro machining, LIGA – SLIGA - Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation - surface bonding - wire bonding - sealing.		
UNIT V	**MICROSYSTEMS DESIGN AND PACKAGING**	**9**
Design considerations - Mechanical Design, Process design, Realization of MEMS components – Micro system packaging technologies - Assembly of Microsystems - Reliability in MEMS.		

Text Book (s)

1	Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", Tata McGraw Hill, New Delhi, 2006.
2	Chang Liu, Foundations of MEMS, Pearson, 2012

Reference (s)

1	Julian W Gardner, Microsensors: Principles and Applications, John Wiley & Sons, 1994.
2	Gardner, Julian W., Varadan, Vijay K. and AwadelKarim Osama, O., "Microsensors MEMS and Smart Devices", John Wiley & sons, New York, 2001.
3	Marc Madou, "Fundamentals of Micro fabrication", CRC press, New York, 1997
4	Sergey Edward Lyshevski, —MEMS and NEMS: Systems, Devices, and Structures‖ CRC Press, 2002

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18ECO001T	MICROCONTROLLERS AND EMBEDDED SYSTEMS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand the functional and architectural characteristics of a PIC microcontroller, memory devices, and key peripheral devices
2	Know about MSP430 architecture, programming and serial interfaces
3	Study the overview of Embedded System Architecture
4	Know various embedded communication protocols.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the architecture and memory organization of the PIC.
CO2	Discuss about the interrupts and timers
CO3	Identify the fundamental need of Low power embedded system
CO4	Gain knowledge of hardware and software architectures of various Embedded Systems.
CO5	Perform various Embedded communication protocols.

CO-PO Mapping

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	1	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	1	-	-	-	-	2	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	1	1	-	-	-	-	-	2
CO (Avg)	3	1.8	1.2	-	1	1	-	-	1	2	-	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	PIC MICROCONTROLLER	9
PIC Microcontroller: CPU Architecture and instruction sets: Hardware architecture and pipelining - program memory consideration – register file structure and addressing modes – CPU Register – instruction set.		
UNIT II	**MICROCONTROLLER TIMER AND INTERRUPTS**	**9**
Timer and interrupts: timer use – interrupt logic – timer 2 scalar initialization. External interrupts and timers: timer0 compare / capture mode – timer1/ CCP programmable period scalar. Timer1 and sleep mode- PWM O/P		
UNIT III	**MSP430 MICROCONTROLLER**	**9**
MSP430 - Functional Block Diagram – Pin Diagram – Low Power Modes – CPU Architecture – Functions and Subroutines – Calling, Parameter passing and Returning – Interrupts – Timers		
UNIT IV	**ARCHITECTURE OF EMBEDDED SYSTEMS**	**9**
Categories of embedded systems – specialties of embedded systems – Recent trends in embedded systems –Hardware architecture –Software architecture –Communication software – Process of generation of executable image – development/testing tools.		
UNIT V	**EMBEDDED COMMUNICATION PROTOCOLS**	**9**
Serial/Parallel Communication - Serial communication protocols - UART - RS232 standard – Serial Peripheral Interface - Inter Integrated Circuits – Ethernet - Universal serial Bus - Controller Area Network - Parallel communication protocols – ISA / PCI Bus protocols.		

Text Book (s)	
1	John B.Peatman, Design with PIC Microcontrollers, Pearson Education Asia, 2002.
2	John H.Davies, MSP430 Microcontroller Basics, Newnes Publishers, 2008.
3	Raj Kamal, "Embedded Systems Architecture Programming and Design", Second Edition,TMH, 2010
4	Prasad.K.V.K.K, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.
Reference (s)	
1	Han.Way Huang, The HCS2/9S12 An Introduction to Hardware and Software Interfacing, Thomson Delmar Cengage Learning, 2005.
2	Wayne Wolf, "Computers as Components - Principles of Embedded Computing System Design", Morgan Kaufman Publishers, First Indian Reprint, 2001.

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18ECO002T	INTERNET OF EVERYTHING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Enables student to understand the basics of Internet of things and protocols.
2	Learn about the different protocols used in IoT
3	Learn about the middleware for Internet of Things
4	Understand the concepts of Web of Things
5	Introduces some of the application areas where Internet of Things can be applied.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Realize the vision of IoT and from a global context
CO2	Analyse the types of protocol used in IoT
CO3	Identify the Devices, Gateways and Data Management in IoT
CO4	Discuss the concepts of Web of Things
CO5	Select the appropriate components for the given application.

CO-PO Mapping

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	1	-	-	-	-	-	-
CO2	3	3	1	-	1	-	1	-	-	-	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	1	-	1	1	1
CO (Avg)	3.0	3.0	1.2	-	1.0	1.0	1.0	1.0	-	1.0	1.0	1.0

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	OVERVIEW OF IoT	9
What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.		
UNIT II	**IoT PROTOCOLS**	**9**
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security		
UNIT III	**IoT ARCHITECHTURE**	**9**
IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity: An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.		
UNIT IV	**WEB OF THINGS**	**9**
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture StandardizationforWoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals andBusiness Intelligence.		
UNIT V	**IoT APPLICATIONS**	**9**
IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.IoT applications for smart cities.		

Text Book (s)	
1	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2	David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
Reference (s)	
1	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013
3	CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18ECO003T	WIRELESS MOBILE COMMUNICATION	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Make students familiar with fundamentals of mobile communication systems
2	Choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc
3	Identify the requirements of mobile communication as compared to static communication
4	Identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G and beyond mobile communication systems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify with various generations of mobile communications.
CO2	Realize the concept of cellular communication.
CO3	Explain the basics of wireless communication
CO4	Combine GSM mobile communication standard, its architecture, logical channels, advantages and limitations
CO5	Gain knowledge of IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations in LTE techniques.

CO-PO Mapping

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-	1
CO3	3	3	1	1	-	-	-	-	-	-	-	-
CO4	3	3	1	1	-	1	-	-	-	-	1	-
CO5	2	3	1	-	-	-	-	-	-	-	1	-
CO (Avg)	2.8	3	1	1	-	1	-	-	-	-	1	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION TO MOBILE COMMUNICATION	9
Overview of wireless communication, cellular communication, different generations and standards in cellular communication system, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID		
UNIT II	**COMMON CELLULAR SYSTEM COMPONENTS**	**9**
Cellular networks architecture, Signal strength and cell area, Common cellular networks components, Components Identification and call establishment.		
UNIT III	**WIRELESS NETWORK ARCHITECTURE AND OPERATION**	**9**
Fundamentals of Cellular Architecture, Mobility Management in Wireless Network, Power Management in Wireless Network, Security in Wireless Network.,		
UNIT IV	**GSM ARCHITECTURE**	**9**
Fundamentals of GSM Network, GSM Frequency Band, GSM PLMN, GSM Objectives, GSM Services, GSM PLMN Subsystems. GSM PLMN Interfaces , GSM Radio Interface, GSM Abis Interface, GSM A Interface , GSM Interface for connecting other components, Mapping of GSM Layers onto OSI Layers, Protocols used across other interfaces of GSM		
UNIT V	**4G –TECHNOLOGY**	**9**
Long Term Evolution (LTE), Mobile Satellite Communication, Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 4G and concept of NGN		

Text Book (s)	
1	Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", 2nd Edition, John Wiley & Sons, 2006.
2	Robert G. Gallager, "Information Theory and Reliable Communications", John Wiley & Sons, 1968.
Reference (s)	
1	Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
2	J. Schiller, "Mobile Communication" 2/e, Pearson Education, 2012

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Regulation 2018		Semester __	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18ECO004T	MEDICAL ENGINEERING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Gain knowledge about the various physiological parameters both electrical and non-electrical and the methods of recording and also the method of transmitting these parameters.
2	Study about the various assist devices used in the hospitals.
3	Gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the Origin of Bioelectric potential and their measurements using appropriate electrodes and Transducers.
CO2	Understand how to measure various biochemical and nonelectrical parameters of human system.
CO3	Understand the Electro-physiology of various systems and recording of the bioelectric signals.
CO4	Understand the working principles of various Imaging techniques.
CO5	Understand the design aspects of various Assist and Therapeutic Devices.

CO-PO Mapping

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	2	3	1	1	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-
CO (Avg)	2.6	2.2	1.6	1	-	-	-	-	-	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	ELECTRO -PHYSIOLOGY AND BIO -POTENTIAL RECORDING	9
The origin of Bio-potentials - bio potential electrodes, Biological acquisition: Physiological signal amplifiers – Isolation amplifiers – Instrumentation amplifier – Chopper amplifier - ECG, EEG, EMG, PCG, EOG, lead systems and recording methods		
UNIT II	**BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT**	**9**
PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters		
UNIT III	**ASSIST DEVICES AND BIO-TELEMETRY**	**9**
Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart Lung Machine, Telemetry principles, Frequency selection, Bio-telemetry, radio-pill and tele-stimulation, Signal sources for Analog I/O, Digital I/O waveform generation for testing and calibration.		
UNIT IV	**RADIOLOGICAL EQUIPMENTS**	**9**
Ionizing radiation, Diagnostic x-ray and CT equipments, use of Radio Isotope in diagnosis-MRI, PET, Nuclear Imaging Techniques, Radio graphic and fluoroscopic techniques, Radiation Therapy.		
UNIT V	**IMAGING MODALITIES AND ANALYSIS**	**9**
Diathermy – Ultrasonography – Endoscopy – Thermography- Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images – LASER in medicine.		

Text Book (s)	
1	Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA McGraw -Hill, New Delhi, 2003.
2	Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2007.)
Reference (s)	
1	Joseph J.Carr and John M.Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 2004.
2	John G Webster, Ed, "Medical Instrumentation Application and Design", Fourth edition, John Wiley & Sons, Singapore,2007

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Regulation 2018		Semester	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18ECO005T	SIGNAL AND IMAGE PROCESSING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand the fundamental concepts of digital signal processing and Image processing.
2	Explore DFT for 1-D and 2-D signal and FFT for 1-D signal.
3	Investigate FFT for 1-D signal.
4	Apply processing techniques on 1-D and Image signals.
5	Apply digital image processing techniques for edge detection.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Apply the concept of DT Signal and DT Systems
CO2	Practice Discrete Fourier Transform and Inverse Discrete Fourier Transform
CO3	Implement Digital Signal Transform techniques using FFT
CO4	Summarize the concept of digital Image Processing
CO5	Discuss about Image Enhancement and Segmentation in Spatial domain

CO-PO Mapping

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	3
CO2	3	3	2	2	-	-	-	-	3	-	-	3
CO3	3	2	2	2	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	3	-	-	3
CO5	3	2	2	2	-	-	-	-	-	-	-	3
CO (Avg)	3	2.4	2	2	-	-	-	-	3	-	-	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	DISCRETE TIME SIGNALS	9
Introduction to Digital Signal Processing, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations(shifting, reversal, scaling, addition, multiplication) - Classification of Discrete-Time Signals, Classification of Discrete Systems - Linear Convolution formulation for 1-D signal, Circular Convolution		
UNIT II	**DISCRETE FOURIER TRANSFORM**	**9**
Introduction to DTFT, DFT, Relation between DFT and DTFT, IDFT - Properties of DFT - DFT computation using DFT properties - Transfer function of DT System in frequency domain using DFT.		
UNIT III	**FAST FOURIER TRANSFORM**	**9**
Need of FFT, Radix-2 DIT-FFT algorithm - DIT-FFT Flow graph for N=4 and 8, Inverse FFT algorithm - Spectral Analysis using FFT		
UNIT IV	**DIGITAL IMAGE FUNDAMENTALS**	**9**
Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization - Representation of Digital Image, Connectivity - Image File Formats: BMP, TIFF and JPEG		
UNIT V	**IMAGE ENHANCEMENT AND SEGMENTATION IN SPATIAL DOMAIN**	**9**
Gray Level Transformations, Zero Memory Point Operations - Histogram equalization – Neighborhood Processing, Spatial Filtering, Smoothing and Sharpening Filters, Median Filter – Image Segmentation based on Discontinuities (Point, Line, Edge)		

Text Book (s)

1.	John G. Proakis, Dimitris and G.Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications' 4th Edition 2007, Pearson Education
2.	A. Anand Kumar, _Digital Signal Processing', PHI Learning Pvt. Ltd. 2013.
3.	Rafel C. Gonzalez and Richard E. Woods, _Digital Image Processing', Pearson Education Asia, 3rd Edition, 2009.
4.	S. Sridhar, Digital Image Processing', Oxford University Press, Second Edition, 2012.

Reference (s)

1.	Sanjit Mitra, Digital Signal Processing: A Computer Based Approach', TataMcGraw Hill, 3rd Edition.
2.	S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, Digital Signal Processing' Tata McGraw Hill Publication 1st Edition (2010)
3.	S. Jayaraman, E. Esakkirajan and T. Veerkumar, Digital Image Processing' TataMcGraw Hill Education Private Ltd, 2009
4.	Anil K. Jain, _Fundamentals and Digital Image Processing', Prentice Hall of India Private Ltd, 3rd Edition

Regulation 2018		Semester	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
X	18ECX001T	MODERN ELECTRONIC INSTRUMENTATION	1	0	0	1

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Outline Health Care System in IoT
2	Learn about the MEMS
3	Understand about the Smart Sensors
4	Know the Basics of ANN.
5	Study about the Evolutionary Techniques of Genetic Algorithm

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the IoT in Health Care System
CO2	Discuss about the Various MEMS
CO3	Discuss about the Various Smart Sensors
CO4	Discuss about the applications of Artificial Neural Network
CO5	Learn the basics of Evolutionary Techniques of Genetic Algorithm

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	1	2	1
CO2	2	1	1	-	-	-	-	-	-	-	-	-	2	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO4	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO (Avg)	2	0.4	0.4	-	-	-	-	-	-	-	-	0.4	1.4	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION	3
Health Care System in Internet of Things -Ingestible sensors.		
UNIT II	**MEMS**	**3**
Silicon Capacitive Accelerometer, An Electrostatic Comb-Drive, A Magnetic Micro relay, Portable Blood Analyzer.		
UNIT III	**SMART SENSORS**	**3**
RF Sensing- Telemetry- Industrial Networks - Home Automation.		
UNIT IV	**ARTIFICIAL NEURAL NETWORK**	**3**
Multi-layer feed forward networks, back propagation algorithms, radial basis function and recurrent networks.		
UNIT V	**EVOLUTIONARY TECHNIQUES OF GENETIC ALGORITHMS**	**3**
Concepts of genetic algorithms - Hybrid Systems: Introduction and Algorithms for Neuro-Fuzzy, Neuro-Genetic.		

Text Book (s)	
1	Internet of Things in Smart Technologies for Sustainable Urban Development, Editors: Kanagachidambaresan G.R., Maheshwari R., Manikandan V, Ramakrishnan K, Springer International Publishing, eBook ISBN 978-3-030-34328-6.
2	Smart Sensors Networks: Communication Technologies and Intelligent Applications (Intelligent Data-Centric Systems: Sensor Collected Intelligence), by Fatos Xhafa (Editor), Fang-Yie Leu (Editor), Li-Ling Hung (Editor) ,Academic Press (8 June 2017).
Reference (s)	
1	Artificial Neural Networks, by Yegnanarayana (Author) Prentice Hall India Learning Private Limited, ISBN-13 : 978-8120312531.
2	Evolutionary Algorithms, Volume 9, Author By Alain Petroski, Sana Ben-Hamida, First Published:14 April 2017,Print Isbn:9781848218048, The Wiley Network.

Regulation 2018		Semester	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
X	18ECX002T	NEXT GENERATION WIRELESS SYSTEMS AND NETWORKS	1	0	0	1

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand a Windows Installations and Configurations.
2	Explain the Principles of Windows Device Manager.
3	Learn about the Mobile IPs.
4	Have the Basic Concept of Smart Antenna Techniques.
5	Understand the concepts of Cognitive Radio Technology.

Course Outcome (s) (COs):

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

CO1	Apply their knowledge about Windows Installations and Configurations.
CO2	Ability to determine the Windows Device Manager
CO3	Analysis the Mobile IPs
CO4	Explain the Concept of Smart Antenna Techniques.
CO5	Describe the Basics of the Cognitive Radio Technology

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	2	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	2	1	-	-	-	-	-	-	-	-	-	3	2
CO4	2	2	1	-	-	-	-	-	-	-	-	2	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	3	2
CO (Avg)	2	0.8	0.4	-	-	-	-	-	-	-	-	0.8	3	2.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	3
Introduction to server, Installation & configuration of Windows servers.		
UNIT II	**USER AND DEVICE MANAGER TOOLS**	**3**
Windows Device Manager for Troubleshooting, Printers -Installing -configuring.		
UNIT III	**ALL-IP WIRELESS NETWORKING**	**3**
Wireless Application Protocol (WAP) - IP on Mobile Ad Hoc Networks.		
UNIT IV	**MIMO SYSTEMS**	**3**
Smart Antenna Techniques -SISO, SIMO, MISO, and MIMO Systems - STBC-CDMA Systems.		
UNIT V	**COGNITIVE RADIO TECHNOLOGY**	**3**
Cognitive Radio –SDR - Challenges to Implement Cognitive Radio - Cognitive Radio Products and Applications		
Text Book (s)		
1	IP in Wireless Networks, Basavaraj Patil, Shavantha Kularatna, Yousuf Saifullah, Lachu Lyengar, Stefano Faccin, Lachu Aravamudhan, Srinivas Sreemanthula, Sarvesh Sharma, Risto Mononen,Pearson Edition .	
2	Cognitive Radio Technology Edited by Bruce A. Fette, British Library Cataloguing-in-Publication Data,Latest Edition.	
Reference (s)		
1.	Large MIMO Systems, Kindle Edition, A. Chockalingam, B. Sundar Rajan, Cambridge University Press (6 February 2014) ISBN: 1107026652.	
2.	Mobile Device Management: Mobility Evaluation in Small and Medium-Sized Enterprises, Markus Pierer ,First Edition, Springer Vieweg; 1st ed. 2016 Edition (August 12, 2016)	

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Regulation 2018		Semester	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
X	18ECX003T	ANDROID APP DEVELOPMENT	1	0	0	1

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand an Android Run Time
2	Explain the Principles of Android Application Structure
3	Learn about the Android OS
4	Study the Basic Concept of Android Layouts
5	Understand the concepts of Security and Challenges of Android in Applications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Apply their knowledge in Android and UI Components
CO2	Ability to determine the Android Application Structure
CO3	Analyse the Android OS
CO4	Explain the Concept of Android Layouts
CO5	Describe the Basics of Security challenges of Android Applications

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	-	-	-	-	-	-	-	1	3	2
CO2	2	-	1	-	-	-	-	-	-	-	-	1	3	2
CO3	2	-	1	-	-	-	-	-	-	-	-	1	3	2
CO4	2	-	1	-	-	-	-	-	-	-	-	1	3	2
CO5	2	-	1	-	-	-	-	-	-	-	-	1	3	2
CO (Avg)	2	-	1	-	-	-	-	-	-	-	-	1.4	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO ANDROID	3
Introduction to Android - Android Run Time- Android Studio and Gradle, Basic Building blocks.		
UNIT II	**APPLICATION STRUCTURE**	**3**
Android Manifest.xml uses-permission Activity/services/receiver declarations Resources and R.java Layouts.		
UNIT III	**ANDROID OS**	**3**
Android Development Tools, Types of Android Applications, Installing Android		
UNIT IV	**BUILDING MOBILE APPLICATIONS WITH ANDROID**	**3**
Android Layouts -Android UI and Advanced Java -Android GUI Architecture Layouts - Android Widget Toolbox.		
UNIT V	**APPLICABILITY TO INDUSTRIAL PROJECTS**	**3**
Bluetooth and NFC in Android device Localization in Android Configuration changes. Security and permissions		

Text Book (s)	
1	Head First Android Development , by Dawn Griffiths , David G,O'Reilly Publications (Recent Edition).
2	Android Programming for Beginners: Build in-depth, full-featured Android 9 Pie apps starting from zero programming experience, 2nd Edition
Reference (s)	
1.	Online material: https://www.tutorialspoint.com/android/android_tutorial.pdf
2.	Online Materials: https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/en/android-developer-fundamentals-course-concepts-en.pdf.