SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2021 – 2022

B. Tech. (ELECTRONICS AND COMMUNICATION ENGINEERING)

Published By

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ISO 9001 : 2015 CERTIFIED ORGANISATION

About the Department

The department was established in the year 2001 with an intake of 60 students for the Under Graduate program. At present the intake has been enhanced to 120 students. The department has been accredited thrice by AICTE-NBA in the year 2008, 2014 & 2019. The well- equipped laboratories with advanced equipment & licensed software support to achieve excellence in design and research.

The Electronics & Communication engineering degree program at RCOEM focuses on problem-solving skills development for real-world applications. Our student-centric learning environment provides a variety of opportunities, including research experience, graduate degree with Honors & Minors, project based learning, and internship opportunities.

A forum called 'Communiqué' has been set up by the department that provides a platform to the students and staff to showcase their talent through various technical, curricular and co- curricular activities.

Salient Features of the Department

- Dedicated team of 20 Faculty members –
  - 11 faculties with Ph.D. qualification, 04 are currently pursuing Ph.D.
  - Involvement of faculty members in sponsored research at institute level as Coordinator/Nodal officer
  - Publications: 8 in SCI indexed journals, 47 Scopus/WoS/ESCI indexed journals and approx. 200 papers published in other peer reviewed journals.
  - Book/Book Chapters : 7
  - Patents : 21 patents (1 Granted, 18 published, 02 filed)
  - Copyrights : 28 Copyrights
  - Membership of professional bodies: IEEE, IETE, ISTE, The International Association of Online Engineering, the International Association of Engineers etc.
  - Dr. S. B. Pokle is nominated as Chairman, Board of Studies of Electronics Engineering, R.T.M. Nagpur University, Nagpur.
  - Dr. R. B. Raut is associated with FOSSEE (Free and Open Source Software for Education) project, IIT Bombay.
  - Dr.(Mrs.) P. K. Parlewar was deputed as Nodal Officer for Visvesvaraya PhD Scheme of Department of Science and Technology in AY 2015-16 for 5 years. Grant Amount is 82.343 Lakh
  - Dr. S. B. Pokle (2019) and Dr. D. G. Khushalani (2018) were awarded with RCOEM Researcher of the year award.
  - Dr. D. G. Khushalani was awarded with Best Project by INUP IIT Bombay
- The Department has
  - Twelve well equipped state–of-the-art laboratories with total investment of 1.64 cr.

- Active Entrepreneur Development cell to develop the employer skills among the students. During the vacation, students go for industry training and enhance their knowledge in various fields.
- Provision of semester long internship for final year students beside summer/winter vacation internship.
- Provision of Honors and Minor specialization in curriculum
- Promotion of MOOCs & provision for credit transfer

- Students have brought laurels to the department by winning Best Branch Trophy thrice, in the year 2017, 2018 and 2019.
- Student Society and Club: Department has student s society „Communiqué which provides a good platform to students to organize various events like Mafia, Mr. & Ms. EC, quiz competition, circuit maze etc. It gives opportunities to students to improve their technical and communication skills. Recently, department has initiated a club, named as „Technocrat club to support hobby projects of students.
- Students are motivated, encouraged and supported to appear in various competitive examinations like GATE, CAT, and GRE etc.
- Best placement among private institute in the region and excellent academic result with consistently achieving above 90% results in every batch

Career Prospects

Graduates can work as technical support engineers, design/research and development engineers, production engineers or service engineers in various fields such as electrical and electronic companies, telecommunications companies, computer hardware or software companies, network companies and many others.

Department Vision

To establish the department as a center of excellence in academics and research with advances in the rapidly changing field of Electronics and Communication

Department Mission

To create stimulating environment for learning and imparting quality technical education to fulfill the needs of industry and society

Program Educational Objectives

The program aims to:

1. Create graduates with basic knowledge of sciences, mathematics and technical expertise with ability to excel in professional career and/or higher education.
2. Develop competent and self motivated professionals with ethical responsibilities.
3. Develop engineers with capability to apply knowledge and evaluate results based on facts, tests, experimentations and research.

4. Inculcate multidisciplinary skills along with leadership and managerial qualities for life- long learning and development.

Program Outcomes

After successful completion of program students will attain:

1. Ability to apply the knowledge of mathematics, science and engineering fundamentals, to solve the engineering problems.
2. Ability to Identify, formulate, and analyze engineering problems using principles of mathematics and engineering sciences.
3. Ability to develop solutions for complex engineering problems and design system components or processes to meet the needs of the society.
4. Ability to use engineering knowledge to design experiments, analyze, interpret data, and synthesize the information to provide valid conclusions.
5. Ability to create, select, and apply appropriate techniques, resources, and modern engineering and simulation tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. Ability to assess and analyze the impact of engineering practices on societal issues.
7. Ability to assess and analyze the impact of engineering practices on environmental issues.
8. Ability to apply ethical principles and commit to professional ethics and responsibilities in engineering practices.
9. Ability to function effectively as an individual or as a leader in diverse teams, and in multidisciplinary field.
10. Ability to communicate effectively, write precise reports, design documentation, make effective presentations for engineering activities
11. Ability to analyze financial aspects involved in Engineering projects with managerial skills
12. Ability to prepare and engage in independent and life-long learning in the context of technological change.

Program Specific Outcomes

The Graduates of Electronics & Communication will be able to:

1. Understand basic concepts of Electronics & Communication Engineering & apply them to design functional blocks of analog & digital systems.
2. Implement effective & appropriate systems in the field of signal processing and communication applications.

Teaching Scheme for First Year (Semester I & II) Bachelor of Engineering
Group 1 : Semester - I / Group 2 : Semester - II

Sr. No.	Code	Course	Hours/week L	Hours/week T	Hours/week P	Credits	Maximum marks: Continuous Evaluation	Maximum marks: End Sem Exam	Maximum marks: Total	ESE Duration (Hrs)
1.	PHT156	Semiconductor Physics	3	1	0	4	40	60	100	03
2.	PHP156	Semiconductor Physics Lab	0	0	3	1.5	25	25	50	–
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability/ Calculus	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	–
5.	EET151	Basic Electrical Engineering	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	0	0	2	1	25	25	50	–
7.	MET151	Engineering Graphics & Design	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	0	0	4	2	50	50	100	–
9.	HUT152	Constitution of India	2	0	0	0	–	–	–	–
10.	PEP151	Yoga / Sports	0	0	2	0	–	–	–	–
		TOTAL	**12**	**2/3**	**13**	**17.5/18.5**			**650**	

Group 2 : Semester - 1 / Group 1 : Semester - II

Sr. No.	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	CHT151	Chemistry	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	0	0	3	1.5	25	25	50	03
3.	MAT151/ MAT152	Calculus/Differencial Equations, Linear Algebra, Statistics & Probability	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	0	0	2	1	25	25	50	–
6.	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	0	0	2	1	25	25	50	–
9.	HUT151	English	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	0	0	2	1	25	25	50	–
		TOTAL	**14**	**2/1**	**9**	**20.5/19.5**			**700**	

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics & Communication Engineering)

Semester III

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PCC	ECT251	Electronic Devices	3	1	0	4	40	60	100	3
2.	PCC	ECP251	Electronic Devices Lab	0	0	2	1	25	25	50	3
3.	PCC	ECT252	Digital System Design	3	0	0	3	40	60	100	3
4.	PCC	ECP252	Digital System Design Lab	0	0	2	1	25	25	50	3
5.	PCC	ECT253	Signals and Systems	3	1	0	4	40	60	100	3
6.	PCC	ECT254	Network Theory	3	0	0	3	40	60	100	3
7.	PCC	ECP255	Electronic Measurement Lab	0	0	2	1	25	25	50	3
8.	BSC	MAT255	Engineering Mathematics	3	0	0	3	40	60	100	3
9.	MC	HUT256	Indian Traditional Knowledge	2	0	0	0	--	--	--	--
			TOTAL	**17**	**2**	**6**	**20**				

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics & Communication Engineering)

Semester IV

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PCC	ECT256	Analog and DigitalCommunication	3	0	0	3	40	60	100	3
2.	PCC	ECP256	Analog and Digital Communication Lab	0	0	2	1	25	25	50	3
3.	PCC	ECT257	Analog Circuits	3	0	0	3	40	60	100	3
4.	PCC	ECP257	Analog Circuits Lab	0	0	2	1	25	25	50	3
5.	PCC	ECT258	Microprocessors	3	0	0	3	40	60	100	3
6.	PCC	ECP258	Microprocessors Lab	0	0	2	1	25	25	50	3
7.	PCC	ECT259	Probability Theory And Stochastic Processes	3	1	0	4	40	60	100	3
8.	BSC	PHT251	Introduction to Electromagnetic Theory	3	0	0	3	40	60	100	3
9.	OEC	ECT299	Open Elective – I	3	0	0	3	40	60	100	3
10.	MC	CHT252	Environmental Science	2	0	0	0	--	--	--	--
			TOTAL	**20**	**1**	**6**	**22**				

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics & Communication Engineering)

Semester V

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PCC	ECT351	Electromagnetic Waves	3	0	0	3	40	60	100	3
2.	PCC	ECP351	Electromagnetic Waves Lab	0	0	2	1	25	25	50	3
3.	PCC	ECT352	Control Systems	3	0	0	3	40	60	100	3
4.	PCC	ECT353	Microcontrollers and Interfacing	3	0	0	3	40	60	100	3
5.	PCC	ECP353	Microcontrollers and Interfacing Lab	0	0	2	1	25	25	50	3
6.	PCC	ECT354	Digital Signal Processing	3	1	0	4	40	60	100	3
7.	PCC	ECP354	Digital Signal ProcessingLab	0	0	2	1	25	25	50	3
8.	PEC	ECT355	Program Elective – 1	3	0	0	3	40	60	100	3
9.	OEC	ECT398	Open Elective – 2	3	0	0	3	40	60	100	3
10.	HSSM	HUP357	Personality Development	0	0	2	1	25	25	50	3
			TOTAL	**18**	**1**	**8**	**23**				

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics & Communication Engineering)

Semester VI

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PCC	ECT356	Computer Architecture	3	0	0	3	40	60	100	3
2.	PCC	ECT357	Computer Network	3	0	0	3	40	60	100	3
3.	PCC	ECP357	Computer Networks Lab	0	0	2	1	25	25	50	3
4.	ESC	CST364	Object Oriented Data Structure	2	0	0	2	40	60	100	3
5.	ESC	CSP364	Object Oriented Data Structure Lab	0	0	2	1	25	25	50	3
6.	ESC	ECP358	Mini Project/Electronic Design workshop	0	0	4	2	25	25	50	3
7.	PEC	ECT359	Program Elective – 2	3	0	0	3	40	60	100	3
8.	OEC	ECT399	Open Elective – 3	3	0	0	3	40	60	100	3
9.	BSC	IDT353	Biology for Engineers	3	0	0	3	40	60	100	3
10.	PCC	ECP360	Comprehensive Viva	0	0	2	1	25	25	50	3
			TOTAL	**17**	**0**	**10**	**22**				

List of Program Elective Courses (PEC) for V and VI Semesters

Sr.	Course Code	Course Title	Semester
1.	ECT355 – 1	Information Theory and Coding	V
2.	ECT355 – 2	CMOS Design	V
3.	ECT355 – 3	Wireless Communication	V
4.	ECT355 – 4	Smart Sensors	V
1.	ECT359 – 1	Speech and Audio Processing	VI
2.	ECT359 – 2	Introduction to MEMS	VI
3.	ECT359 – 3	Biomedical Electronics	VI
4.	ECT359 – 4	Introduction to IoT	VI

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics &Communication Engineering)

Semester VII

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PEC	ECT451	Program Elective -3	3	0	0	3	40	60	100	3
2.	PEC	ECT452	Program Elective -4	3	0	0	3	40	60	100	3
3.	PEC	ECT453	Program Elective -5	3	0	0	3	40	60	100	3
4.	OEC/ HSSM	HUT498-1	Open Elective – 4 (Technical Communication)	3	0	0	3	40	60	100	3
5.	HSSM	HUT452	Engineering Economics	3	0	0	3	40	60	100	3
6.	ESC	ECP454	Industry Internship Evaluation (6–8 weeks)	0	0	2	0	--	--	--	--
7.	PR	ECP455	Project Stage-I	0	0	10	5	50	50	100	3
			TOTAL	**15**	**0**	**12**	**20**				

Scheme of Teaching & Examination of Bachelor of Engineering (Electronics & Communication Engineering)

Semester VIII

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	PEC	ECT456	Program Elective -6	3	0	0	3	40	60	100	3
2.	PEC	ECT457	Program Elective -7	3	0	0	3	40	60	100	3
3.	PR	ECP458	Project Stage-II/ 1 Semester Industry Internship	0	0	18	9	50	50	100	3
			TOTAL	**6**	**0**	**18**	**15**				
						OR					
4.	PR	ECP459	Full Semester Internship	**-**	**-**	**-**	**15**	**100**	**100**	**200**	**-**

Department of Electronics & Communication Engineering

List of Program Electives Courses (PEC) for VII and VIII Semesters

Sr.	Course Code	Course Title	Semester
1.	ECT451 – 1	Embedded Systems	VII
2.	ECT451 – 2	Microwave Theory and Techniques	VII
3.	ECT451 – 3	Digital Image and Video Processing	VII
4.	ECT452 – 1	Optical Fiber Communication	VII
5.	ECT452 – 2	Broadband Communication	VII
6.	ECT452 – 3	Wireless Sensor Networks	VII
7.	ECT453 – 1	Error Correcting Codes	VII
8.	ECT453 – 2	Long-Term Evolution Technologies	VII
9.	ECT453 – 3	Machine Learning	VII
1.	ECT456 – 1	Robotics	VIII
2.	ECT456 – 2	Computer Vision	VIII
3.	ECT456 – 3	Antenna Theory	VIII
4.	ECT457 – 1	Real Time Operating Systems and Kernels	VIII
5.	ECT457 – 2	Adaptive Signal Processing	VIII
6.	ECT457 – 3	Artificial Intelligence	VIII

List of Open Electives

Sr. No.	Semester	Course Code	Courses
1	IV	ECT299	ECT299 – 1: Renewable Energy
			ECT299 – 2: Evolution in Communication Technologies
2	V	ECT398	ECT398 – 1: Electronics in Agriculture
			ECT398 – 2: Sensors and Transducers
3	VI	ECT399	ECT399 – 1: Multimedia Communications
			ECT399 – 2: Information and Communication Technologies in Rural Sector
4	VII	HUT498– 1	HUT498 – 1: Technical Communication

Honors Scheme

Sr. No.	Semester	Course code	Course Title	Hours per Week	Credits	Maximum marks			ESE Duration (Hrs)
						Continuous Evaluation	End Sem Exam	Total	
1.	IV	ECTH41	Communication System Analysis	4	4	40	60	100	3
2.	V	ECTH51	Radio Frequency Circuit Design	4	4	40	60	100	3
3.	VI	ECTH61	Multimedia Networks	4	4	40	60	100	3
4.	VII	ECTH71	Cryptography and Information Security	4	4	40	60	100	3
5.	VIII	ECTH81	Evolution of Air Interface towards 5G	4	4	40	60	100	3

Minor Scheme

Sr. No.	Semester	Course code	Course Title	Hours per Week	Credits	Maximum marks			ESE Duration (Hrs)
						Continuous Evaluation	End Sem Exam	Total	
1.	IV	ECTM41	Communication Engineering	4	4	40	60	100	3
2.	V	ECTM51	Sensors for Smart City	4	4	40	60	100	3
3.	VI	ECTM61	IoT for Industrial Application	4	4	40	60	100	3
4.	VII	ECTM71	Mobile Communication	4	4	40	60	100	3
5.	VIII	ECTM81	Future Generation Networks	4	4	40	60	100	3

Syllabus for Semester I / II

Course Code : PHT156 **Category : Basic Science Course**

Course : PHYSICS : Semiconductor Physics (Theory)

L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits : 4**

Course Objective

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;
2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

Course Outcomes

After successful completion of the course students will

1. have an elementary understanding of quantum behaviour of electrons in solids;
2. have a grasp of band structure and its consequences for semiconductors;
3. should be able to use band structure to explain effects of doping,on the properties of junctions between semiconductors and metals;
4. have an elementary understanding of working of optoelectronic devices

Module 1: Quantum Mechanics Introduction

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling, One electron atom, periodic table, Quantum confinement effects in nanosystems

Module 2: Electronic Materials

Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap based classification of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

Module 3: Intrinsic and Extrinsic Semiconductors

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift.

Module 4: Non-Equilibrium Semiconductors

Carrier generation and recombination, Continuity equation, Ambipolar transport equation, Quasi-Fermi Energy levels, Excess Carrier Lifetime, Qualitative introduction to recombination mechanisms, Shorkley-Read-Hall Recombination, Surface Recombination

Module 5: Junction Physics

p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non-rectifying barrier, tunneling barrier, Heterojunctions, Nanostructures, Energy band diagram, two dimensional electron gas

Module 6: Light - Semiconductors Interaction

Optical absorption in semiconductors, Light emitting diodes, Principles, Device Structures, Materials, High Intensity LEDs, Characteristics, LASERS, Stimulated emission and photon amplification, Einstein Coefficients, Laser oscillation conditions, Laser diode, Solar Energy Spectrum, photovoltaic device principles, Solar Cells

Text Book(s)

Modules 1-5

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.

Reference

1. Physics of Semiconductor Devices, S. M. Sze, 2nd Edition, Willey-Interscience Publication 1986

Modules 6

1. Online course: Semiconductor Optoelectronics by M. R. Shenoy on NPTEL
2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall 2001

Syllabus for Semester I / II

Course Code : PHP156 **Category : Basic Science Course**

Course : Semiconductor Physics (Lab)

L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Lab course consists of experiments illustrating the principles of physics relevant to the study of science and engineering. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the General physics experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

General Physics

1. Error analysis and graph plotting
2. Newton's law of cooling
3. Simple Pendulum
4. Magnetic flux using deflection magnetometer
5. Dispersive power and determination of Cauchy's constants
6. Data analysis using Mathematica.
7. Cathode Ray Oscilloscope

Semiconductor Physics and Devices

1. Energy gap of semiconductor/thermister
2. Study of Hall Effect
3. Parameter extraction from I-V characteristics of a PN junction diode
4. Parameter extraction from I-V characteristics of a zener diode

5. Study of diode rectification
6. Parameter extraction from I-V characteristics of a transistor in common-emitter configuration.
7. V-I Characteristics of Light Emitting Diodes
8. Study of a photodiode
9. Solar Cell (Photovoltaic cell)
10. Resistivity measurement by Four Probe method

A minimum of 8 experiments to be performed from the following list of experiments

Syllabus for B.E. Semester I / II

Department of Electronics and Communication Engineering

Course Code : MAT151 **Course : Calculus**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 04**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module - I : Differential Calculus: (12hours)

Taylor's and Maclaurin's series expansions; radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module - II : Integral Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module - IV : Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module - V : Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module - VI : Vector Calculus (10 hours)

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes and their applications.

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References

1. 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. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

Syllabus for B.E. Semester I / II

Department of Electronics and Communication Engineering

Course No. MAT152 **Course : Differential Equations, Linear Algebra, Statistics & Probability**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and Matrices.

It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1:First order ordinary differential equations(7 hours)

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

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3:Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning

Application of Differential Equations.

Textbooks / References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus of Mathematics Computational Lab for Semester I/II, B.E. (2018-19)

Course Code : MAP151 **Course : Computational Mathematics Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EET151 Course : Basic Electrical Engineering

Course Outcomes

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

CO1: Understand and analyze basic ac and dc electric circuits and magnetic circuits

CO2: Understand working principles of electrical machines: Transformer, Induction motor, DC machines

CO3: Apply the knowledge of power converter for suitable applications

CO4: Introduce and identify the components of power systems and low-voltage electrical Installations.

Module 1: Introduction to Power system (2 hours)– CO4:

Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind, and Solar) with block schematic presentation only. Single line diagram for Generation, Transmission & Distribution through different voltage levels.

Module 2 : DC Circuits & Magnetic Circuits(8 hours) - CO1:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation, Time-domain analysis of first order RL and RC circuits, Magnetic materials, BH characteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours) - CO1:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module 4: Three Phase AC Circuits (4 hours) - CO1:

Three phase Ac generation, Three phase balanced circuits, voltage, and current relations in star and delta connections. Power factor improvement.

Module 5: Transformers (6 hours) - CO2:

Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation, and efficiency. Auto transformer and three-phase transformer connections.

Module 6: Electrical Machines (8 hours) - CO2:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components, efficiency, starting of induction motor. Single- phase induction motor. Construction, working, torque-speed characteristic, and speed control of separately excited dc motor.

Module 7: Power Converters (4 hours) - CO3:

Block schematic introduction to power converters and its practical applications (DC-DC, DC-AC, AC-DC, AC- AC), Types of Batteries, Important Characteristics for Batteries and battery backup.

Module 8: Electrical Installations (4 hours) - CO4:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, energy tariff.

Text / References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
6. Electrical Technology: B. L. Thereja, S. Chand Publications.
7. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EEP151 **Course: Basic Electrical Engineering Lab.**

Course Outcomes

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

CO1: Co-relate, analyze and apply the fundamental principles of science and engineering to understand the laboratory experimental work.

CO2: Connect the electric circuit, perform the experiment, analyze the observed data and make valid conclusion.

CO3: Write report based on the performed experiments (journal) with effective presentation of diagrams and characteristics/graphs.

CO4: Carry out survey of electrical energy consumption at home and calculate monthly energy bill as per the tariff of power Distribution Company.

List of Experiments

1. To verify Kirchhoff's laws for D.C. Circuits
2. Verification of Kirchhoff's laws to AC circuit(RLC series)
3. Verification of Kirchhoff's laws to AC circuit (RLC parallel).
4. To study speed control of D.C. shunts motor by:
   a) Armature voltage Control method.
   b) Field current/flux control method.
5. To study the balanced Three phase system for star and delta connected balanced load.
6. Improvement of power factor by using static capacitors
7. To determine regulation and efficiency of a single phase transformer by open circuit (o.c) and short circuit (s.c.) tests.
8. To determine regulation and efficiency of a single phase transformer by direct loading test

Demonstration/ Study experiment

9. To study B-H curve for different magnetic material
10. To study Buck converter
11. To study Boost converter

Demonstration of cut out sections of machines:

i. DC Machine
ii. Three phase squirrel cage induction motor
iii. Synchronous machine

Syllabus of Department of Mechanical Engineering

Course Code : MET151 **Course: Engineering Graphics and Design**

L:1 Hr., T:0Hrs., P:0 Hrs., Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions : Projections of Points and lines (line inclined to both planes) Projections of planes (inclined to both the planes), Introduction to Auxiliary Planes;

UNIT 3 : Projections of Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include : windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views / Projection.

Suggested Text / Reference Books

i) Bhatt N. D. Panchal V.M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi.

iii) Narayana K. L. & P. Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

iv) Shah, M. B. & Rana B. C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C. M. (2012), Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Syllabus of Department of Mechanical Engineering

Course Code : MEP151 **Course : Engineering Graphics & Design Lab**

L:0 Hr., T:0Hrs., P:4 Hrs., Per week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to :

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

UNIT 1 : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions - Projections of Points and lines inclined to both planes; Projections of planes - Auxiliary Planes.

UNIT 3 : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection

UNIT 6 : Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as (the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids);

UNIT 7 : Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic constraints, map to objects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

UNIT 8 : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

UNIT 9 : Demonstration of a simple team design project that illustrates

Geometry and Topology of Engineered Components Creation of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed toplogies for engineering, Introduction to Building Information Modeling (BIM), Drafting and design package, 3D printing.

List of sheets

1. Curves (ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthographic Projection
5. Isometric
6. Auto CAD practic sheet 1
7. Auto CAD practice sheet 2
8. Blueprint sheet

Suggested Text/ Reference Books

i) Bhatt N.D. Panchal V.M. & Ingle P.R., (2014), Engineering drawing, Charotar Publiishing house

ii) Jolhe D.A., (2016) Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

iii) Shah M.B. & Rana B.C. (2008), Engineering drawing and Computer Graphic, Pearson Education.

iv) Agarwal B & Agarwal C.M. (2012), Engineering Graphics, TMH PUBLICATION

v) Narayana, K.L & P Kannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.

vi) (Concesponding set of) CAD Software Theory and USER Manuals.

Syllabus for B.E. Semester I, Department of Humanities

Course Code : HUT152 **Course : Constitution of India**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

Syllabus for B.E. Semester I, Department of Physical Education

Course Code : PEP151 **Course : Yoga / Sports**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits : 0**

Course outcome

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

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes:

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline:

- **Sports :**

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

- **Yoga :** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.
- **Physical Efficiency Tests :** This includes 6 health related physical fitness tests.

Components	Name of Tests
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M) / shoulder strength (F)	Bent Knee Sit-ups (M)/ Modified Pull-ups (F)
Yogic exercises	Suryanamaskars

Syllabus for B.E. Semester I / II

Course Code : CHT151 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 4**

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10 + 2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand different phenomena; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Explain the differences in the behavior of engineering materials based upon bond type, structure, composition, and processing.
- Analyse microscopic chemistry in terms of atomic and molecular orbitals and to apply this knowledge for understanding the band structure of different types of solids.
- Understand different types of molecular interactions, rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- List major chemical reactions that are used in the synthesis of molecules and to understand structural aspect of organic compounds.
- Analyse impurities present in the water and suggest the methodology for its removal.

Chemistry (Concepts in Chemistry for Engineering)

(1) Engineering Materials (8 Lectures) : Polymeric Materials : Introduction, polymer composites, fibre reinforced composites, Biopolymers (Polylactic acid etc.). Engineering applications of polymers (optical media, data storage, devices, electronics and medical sector).

Nanomaterials : Definition of Nano, Top down bottom up approach, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical, optical properties.Applications of Nanomaterials.

Cement : Raw materials, manufacturing of cement, properties (settling and hardening, heat of hydration, soundness), Types of cement, Rapid hardening, Pozzolonic cement, white cement, High Alumina Cement.

(2) Atomic and molecular structure (8 lectures) : Schroedinger equation. Particle in box solutions, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Equations for atomic and molecular orbitals. Molecular Orbital Theory and Molecular orbital diagrams of different homo-nuclear and hetero-nuclear diatomic molecules. Pi- molecular orbital diagram of butadiene benzeneand hexatriene.

Crystal field theory and the energy level diagrams for octahedral and tetrahedral complexes of transition metal ions and their magnetic properties.

Band structure of solids and the role of doping on band structures.

(3) Spectroscopic techniques and applications (8 lectures) : Electromagnetic Spectrum, Principles of spectroscopy.

Electronic spectroscopy – Basic Principles, Lambert-Beer's Law, Woodward-Fisher Rule for conjugated dienes.

Fluorescence and its applications in medicine.

Nuclear magnetic resonance – Basic Principles, Chemical Shift, Spectral interpretation of some simple compounds.

(4) Chemical Thermodynamics and Corrosion Science(6 lectures) : Thermodynamic functions: energy, work, entropy, ethalpy and free energy and numerical based on these thermodynamic functions.

Corrosion – Basic principle, mechanism of corrosion, overview of types of corrosion and preventive measures.

(5) Stereo chemistry and Organic Reactions (8 lectures) : Stereoisomers, configurations and symmetry & chirality, enantiomers, diastereomers, optical activity.

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction. Synthesis of a commonly used drug molecule such as Ibuprofen, Aspirin, Paracetamol, Chloroquine/ doxy cycline etc.

(6) Water Technology (6 lectures) : Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion- exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosisand electrodialysis.

Suggested Text Books

1. A Textbook of Engineering Chemistry by Dr. Rajshree Khare, S. K. Kataria and Son's Publisher.
2. Selected topics in Inorganic Chemistry by W. U. Malik, R. D. Madan &G. D. Tuli, S. Chand Publications.
3. Engineering Chemistry by A. Pahari, B. Chauhan, Firewall Media, Infinity Science Press LLC.
4. A Textbook of Engineering Chemistry by S. S. Dara, S. Chand Publications.
5. Applied Chemistry by V. K. Walekar, A. V. Bharati, Tech-Max Publications.
6. Organic Chemistry by R. L. Madan, Mc-Graw Hill Publications.
7. Elementary Organic Spectroscopy, Revised Edition by Y. R. Sharma, S. Chand Publications.
8. Organic Chemistry – Reactions and Reagents by O. P. Agrawal, Goel Publishing House Publications.
9. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Reference Books

1. Physical Chemistry, by Robert G. Mortimer, Elsevier Academic Press Publications.
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, Mc-Graw Hill Publications.

Syllabus for B.E. Semester I / II

Course Code : CHP151 **Course : Chemistry Lab**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits : 1.5**

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

- Estimate the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.

List of Experiments for Chemistry Lab

1. Determination of Surface tension of a given liquid/mixture.
2. Determination of Viscosity of a given liquid/mixture.
3. Estimation of total, temporary and permanent hardness present in a given water sample.
4. Estimation of type and extent of alkalinities present in a given water sample.
5. Estimation of Cu and Zn in a brass sample.
6. Study of chemical oscillations or iodine clock reaction and determination of rate constant of the reaction.
7. Estimation of acid value of oil.
8. Estimation of saponification value of oil.
9. Ion Exchange column for removal of hardness.
10. Study of adsorption of acetic acid by charcoal.
11. Synthesis a polymer / drug molecule / nano-material.

Suggested Books/Reference Books

(1) A Textbook on Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chand Publications.

(2) Advanced Practical Physical Chemistry by J. B. Yadav, Krishna's Prakashan Media (P) Limited.

(3) Collection of Interesting General Chemistry Experiments, A by A. J. Elias, Universities Press Publications.

(4) College Practical Chemistry by V. K. Ahluwalia, S. Dhingra and A. Gulati, Universities Press Publications.

(5) Advanced Practical Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CST151 **Course : Programming for Problem Solving**

L: 4 Hrs.,T: 0 Hrs.,P: 0 Hrs.,Per week **Total Credits : 4**

Course Outcomes

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays to solve various matrix operation, searching, sorting and Pointers, Structures for the formulation of algorithm and Programs.
4. To understand basics of file operation and to apply various I/O operations for file handling programming.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings.

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation) UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

Text Books:

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books:

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CSP151 **Course : Programming for Problem Solving Lab**

L: 0 Hrs.,T:0 Hrs.,P:2 Hrs.,Per week **Total Credits : 1**

Course Outcomes

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

CREATIVITY INNOVATION AND DESIGN THINKING COURSE SYLLABUS

Course Code : IDT151 **Credits : 1**

L:1Hrs., T:0Hrs., P:0Hrs., Per week

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

UNIT I. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking: Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

UNIT 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

UNIT 5. Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

UNIT 6.Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Book :

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus Department of Industrial Engineering

Course Code : INT151 **Course : Workshop / Manufacturing Practices (Theory)**

L:1Hrs., T:0Hrs., P:0Hrs., Per week **Total Credits:1**

Course Outcomes

1. Identify the different manufacturing process commonly employed in Industry along with prevailing safety practices.
2. Identify the various tools and equipments to carry out different manufacturing processes accompanied by the inspection of the work part.

Syllabus

Unit - 1 Fundamentals of metal cutting, single point cutting tool, fundamental mechanics of metal cutting, fitting operations, and associated measuring and marking tools

Unit - 2 Introduction to pattern making for metal casting, different types of carpentry tools, measuring tools and marking tools, holding devices, different types of carpentry joints.

Unit - 3 Smithy and Forging, Forging tools like chisels, hammers, types of furnaces, types of coal, Forming operations, Hot working and Cold working of metals.

Unit - 4 Metal joining Process, mechanics of welding, types of welding, soldering and brazing, types of joints.

Unit - 5 Introduction to foundries, Metal Casting, types of sand, Introduction to Molding tools & casting process.

Unit - 6 Introduction to Plastic Injection Molding

Suggested Text Book

1. "Elements of Workshop Technology" Hajra S.K, Choudhury A. K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd. Mumbai.

Reference Books

1. Kalpakjian S. and Schmid S. “Manufacturing Engineering and Technology”4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture”4th Edition, Prentice Hall India 1998.

Syllabus Department of Industrial Engineering

Course Code : INP151 **Course : Workshop/Manufacturing Practices Lab (Practical)**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits :1**

Laboratory Outcomes

On the completion of the course the students shall be able to;

1. Recognize the different manufacturing process commonly employed in the Industry
2. Make the components using required manufacturing process, inspection methods while practicing the requisite safety precautions

Contents

1. Fitting Practice
2. Welding and Soldering Practice
3. Pattern Making Practice
4. Metal Casting Practice
5. Smithy and Forging Practice
6. Machining Practice
7. Plastic Molding Process
8. Glass Cutting

Suggested Text Book

1. "Elements of Workshop Technology'" Hajra S.K, Choudhury A.K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd Mumbai.

Reference Books

1. Kalpak Jain S. and Schmid S. "Manufacturing Engineering and Technology"4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, "Process and Materials of Manufacture", Prentice hall India 1998.

Syllabus for B.E. Semester I / II Dept of Humanities

Course Code: HUT151 **Course : English**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 2**

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Redundancies

3.6 Cliches

4. Nature and Style of sensible Writing

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

5. Writing Practices

5.1 Comprehension

5.2 Precis Writing

5.3 Essay Writing

5.4 Letter Writing

5.5 Email Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for B.E. Semester I

Course Code: HUP151 **Course : English Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits : 1**

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation, Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

III Semester
Department of Electronics and Communication Engineering

Course Code: ECT251 **Course: Electronic Devices**

L: 3 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

The objective of the course is to prepare the students:

1. To learn electrical properties, characteristics and behavior of basic solid state devices such as PN junction diode/BJT/MOSFET/JFET.
2. To develop analog applications in circuit design using device models.

Course outcomes

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

1. Understand the applications of Diode Circuits.
2. Analyze different amplifier configurations & low frequency analysis of amplifier.
3. Understand FET Amplifier Circuits.
4. Know the fundamentals of VLSI and CMOS Technology.

Unit I

P-N junction as a Diode: – Characteristics, resistance, capacitance, small signal switching models, diode switching time; Diode Circuits, Rectifiers, Zener diode, shunt voltage regulator, Schottky diode, Varacter Diode, Tunnel Diode.

Unit II

Bipolar Junction Transistor: - Basics of BJT, configurations, Operation and Input/Output characteristics, Load line concept, Biasing Schemes, Bias stabilization, Compensation Techniques.

Unit III

Field effect Transistor: - JFET – Classification, construction, Operation, Characteristics; various configurations of FET amplifier (CS, CD, CG) and their features, Biasing schemes for FET amplifier, FET as VVR.Unit IV

Frequency analysis of Amplifier: - Hybrid model, Determination of h-parameters from Input and Output characteristics, Analysis of amplifier circuit using h-parameters, simplified Hybrid model, estimation of voltage gain, current gain, input resistance, output resistance etc.

Unit V

Introduction to MOS Technology and VLSI: - Classification of ICs, MOS transistor, MOS capacitance, C-V characteristics, MOSFET I-V characteristics, Body Effect, Electrical properties of MOS, Introduction to MESFET and HFET.

Unit VI

CMOS Technology: - Digital Logic, MOSFET Approximations, CMOS Logic gates, CMOS Inverter, Pass Transistors and Transmission Gates, Tri-states, Pseudo-nMOS logic, CMOS domino logic, Dynamic CMOS Logic, Clocked CMOS (C2MOS) Logic.

Text Books

1. Integrated Electronics: Millman, Halkias,Parikh TMH, 2nd Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective: Neil Weste and David Harris, Addison-Wesley (Pearson), 4th Edition

Reference Books

1. Electronic devices and Circuit Theory: R. Boylestad, Pearson Education 9th edition
2. Foundation of Electronics Circuits and Devices: Meade Thompson, 4th Edition
3. Basic VLSI Design: Douglas Pucknell and Kamran Eshraghian, PHI 3rd Edition.
4. Solid State Electronic Devices: Ben G. Streetman, Pearson Education 6th edition
5. Electronic Devices and Circuits: David A. Bell, PHI. 4th Edition
6. An Introduction to semiconductor Devices: Donald Nemen, Tata-McGraw Hill
7. Electronic Circuits – Analysis and Design: Donald Nemen, Tata-McGraw Hill

III Semester

Department of Electronics and Communication Engineering

Course Code: ECP251 **Course: Electronic Devices Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

The objective of the course is to prepare the students:

1. To verify the characteristics of different electronic devices.
2. To use simulation software for analysis of electronic circuits.

Course outcomes

1. The students will be able to verify the characteristics of PN junction Diode, BJT and FET.
2. The students will be able to use the different electronic devices to design a system.
3. The students will be able to find the h-parameters from the characteristics of BJT.
4. The students will be able to use the simulation software – ORCAD for analysis of different electronic circuits and compare it with the hardware results

Experiments based on following topics:

- PN Junction Diode Characteristics
- Zener as Voltage Regulator
- Rectifiers
- Input/Output Characteristics of BJT
- Biasing of BJT
- Characteristics of JFET/MOSFET
- CMOS Circuits
- Circuit Simulation using ORCAD

III Semester

Department of Electronics and Communication Engineering

Course Code: ECT252 **Course: Digital System Design**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives

1. To acquire the basic concepts of Verilog and application to understand digital systems.
2. To determine the output and performance of given combinational and sequential circuits.
3. To understand Hardware Implementation of design circuits using Verilog.
4. To acquire knowledge of various logic families of Digital circuits.

Course outcomes

1. To understand the concept of Verilog.
2. Design combinational and sequential circuits using Verilog.
3. Hardware Implementation using Programable logic Devices.
4. To understand various kinds of Logic families and its concepts.

Unit - I

Introduction to Logic Gates and implementation in Combinational Logic Design, Introduction to Verilog, Fundamentals of Verilog including language basics and relation to circuit implementation, Concept of SOP,POS and Karnaugh maps.

Unit - II

Modules and Ports in Verilog, modeling techniques in Verilog, Task and Functions, Synthesis and Simulation, Timing and delays, Verilog constructs and codes for combinational and sequential circuits.

Unit - III

Combinational Circuits (using Verilog): Comparators, Multiplexers and Demultiplexer, Encoder, Decoder, Halfand Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

Unit - IV

Sequential Circuits (using Verilog): Latches/buffers and Flip-Flops as memory storage elements, Counters, Shift registers and its variants, Memory and its internal organization, FSM design.

Unit - V

Concepts and Generic architecture of PAL, PLA, PLD and FPGA's, Synthesis and Implementation of Boolean functions using programable logic devices.

Unit VI -

Semiconductor Logic Families: TTL, ECL,CMOS and its study of Performance parameters, Project activity based on above curriculum.

Text Books

1. R.P.Jain,"ModerndigitalElectronics",TataMcGrawHill,4thedition,2009.
2. Stephen Brown and ZvonkoVranesic, "FundamentalsofDigital Logic with Verilog Design" TataMcGrawHill, 3rd ed, 2009.

Reference Books

1. Douglas Perry, "VHDL", Tata McGraw Hill, 4thedition, 2002
2. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice" , PHI, 2nd edition, 2006
3. M. Morris Mano and Michael Ciletti,"Digital Design: With an Introduction to Verilog HDL", 5e, 2011
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Samir Palnitkar"Verilog HDL-A guide to Digital Design and Synthesis"SunSoft Press 1996
6. Charles Roth, "Digital System Design using VHDL" , Tata McGraw Hill 2nd edition 2012

III Semester
Department of Electronics and Communication Engineering

Course Code : ECP252 **Course : Digital System Design Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits : 01**

Course Objectives

1. To acquire the basic concepts of Verilog and application to understand digital systems.
2. To determine the output and performance of given combinational and sequential circuits.
3. To understand basic requirement for a design application in Verilog.
4. To learn field programmable gate array (FPGA) technologies to synthesize and analyze digital systems.

Course Outcomes

1. To use simulation tools to implement and test Verilog based design.
2. To design basic combinational and sequential circuits.
3. To design arithmetic blocks in Verilog and implement the same.
4. To design Verilog codes for small scale computer blocks.
5. To implement Verilog based designs on CPLD/FPGA.

Experiments based on following topics:

1. Combinational and sequential circuits.
2. Different techniques of modeling.
3. Verilog statements and test benches.
4. Design of arithmetic blocks in Verilog and implement the same.

III Semester
Department of Electronics and Communication Engineering

Course Code : ECT253 **Course : Signals and Systems**

L: 3 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. Fundamental concepts and transforms as relevant to time and frequency domain signals.
2. Analysis of continuous & discrete time systems.

Course outcomes

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

1. Analyze different types of signals & systems.
2. Represent continuous and discrete systems in time and frequency domain.
3. Investigate stability of the system.
4. Carry out Fourier Analysis of System.

Unit - I

Signals and systems as seen in everyday life, in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit - II

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with aperiodic & periodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations

Unit - III

Laplace domain analysis of system, region of convergence, poles and zeros of system, solution to differential equations and system behavior. Notion of Eigen functions of LSI systems, a basis of Eigen functions.

Unit - IV

The Sampling Theorem and its implications- Spectra of sampled signals. Aliasing and its effects. Relation between continuous and discrete time systems. The z-Transform for discrete time signals and systems- region of convergence, z-domain analysis. Concept of interpolation of signal.

Unit - V

The notion of a frequency response of LSI and its relation to the impulse response, Fourier Analysis of Signals and Systems, Response of LTI systems to complex Exponentials, Concept of eigen function and eigen value of a system, Fourier Series Representation of Continuous Time and Discrete Time Periodic Signals (CTFS and DTFS), Magnitude and Phase Spectrum of Periodic Signal, Dirichlet s Conditions for Convergence of Fourier Series, Application of Fourier Series.

Unit - VI

Continuous Time Fourier Transform (CTFT), Discrete Time Fourier Transform (DTFT), Magnitude and Phase Response, Properties of CTFT and DTFT, Continuous Time LSI system Characterized by Linear Constant Coefficient Differential Equations, Discrete Time LSI System Characterized by Linear Constant coefficient Difference Equations, Introduction to the Discrete Fourier Transform (DFT), Parseval's theorem.

Text Books

1) B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.

2) Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

3) A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

4) V. Krishnaveni, A. Rajeswari, “Signals and Systems”, Wiley India Pvt. Ltd., New Delhi, 2013.

Reference Books

1) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.

2) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

3) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.

4) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

5) Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

6) R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.

7) Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.

III Semester
Department of Electronics and Communication Engineering

Course Code : ECT254 **Course : Network Theory**

L: 3Hrs, T: 0Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of the course is to make students capable of –

1. Analyzing different electrical networks.
2. Solving electrical circuits using suitable network theorems and methods.
3. Applying suitable transformation techniques to analyze electrical circuits in time and frequency domain.
4. Understanding different parameters of two port networks.

Course Outcomes

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

1. Understand and analyze basic electrical circuits using nodal and mesh analysis.
2. Understand the applicability of electrical network theorems; evaluate 3-phase circuits with unbalanced load.
3. Apply Laplace Transform for steady state and transient analysis.
4. Evaluate and analyze steady state response of networks to non-sinusoidal inputs.
5. Understand and apply basic frequency domain techniques.
6. Understand different parameters of two port networks.

Unit - I

Node and Mesh Analysis, matrix approach of networks containing voltage sources, current sources, reactances, coupled circuits, source transformation, duality properties in the electrical networks.

Unit - II

Network theorems: Superposition, reciprocity, Thevenin s, Norton s, Maximum power Transfer, compensation and Tellegen's theorem as applied to D.C. and AC. circuits.Unit III

Analysis of RC, RL, and RLC networks with and without initial conditions using Laplace transform, transient behavior, evaluation of initial conditions, Waveform synthesis.

Unit - IV

Steady state response of electrical networks to non-sinusoidal periodic inputs, three phase unbalanced circuit, power calculation, power factor, effective values.

Unit - V

Concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorems

Unit - VI

Two port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text Books

1) Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.

2) Ravish R. Singh, "Electrical Networks" Tata McGraw Hill Education Private Limited (3 July 2008).

3) Van, Valkenburg.; " Network analysis" ; Prentice hall of India, 2000.

Reference Books

1) A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education.

III Semester
Department of Electronics and Communication Engineering

Course Code : ECP255 **Course: Electronic Measurement Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits : 01**

Course Objectives

1. To understand DC and AC bridges and their applications.
2. Learnaboutvariousmeasurementdevices,theircharacteristics,theiroperationandtheir limitations
3. Understand statistical data analysis
4. Understand computerized data acquisition.

Course outcomes

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

1. To analyze DC and AC bridges
2. Perform measurements using different instruments and reduce errors.
3. Perform statistical data analysis
4. Acquire data and perform signal conditioning.

Experiments based on

- DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
- AC bridge Circuit for capacitance measurement
- Signal Conditioning circuit for Pressure Measurement
- Signal Conditioning circuit for Temperature Measurement
- Experimental study for the characteristics of ADC and DAC
- Error compensation study using Numerical analysis using MATLAB (regression)
- LABVIEW

III semester

Department of Electronics and Communication Engineering

Course Code: MAT255 **Course : Engineering Mathematics**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Outcomes

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

1. Solve field problems in engineering involving PDEs.
2. Understand complex variable.
3. Understand Laplace transforms, Z-transform to solve engineering problems.

Module 1: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding

harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 2: Complex Variable – Integration: (9 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville s theorem and Maximum-Modulus theorem (without proof); Taylor s series, zeros of analytic functions, singularities, Laurent s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Module 3: Partial Differential equations: (8 lectures)

Partial differential equation of first order first degree i.e. Lagrange s form. Linear homogeneous PDE of nth order with constant coefficient, method of separation of variables, Applications of partial differential equations.

Module4: Laplace Transform:(10 lectures)

Laplace transforms and their properties, Application of Laplace Transform to solve differential equations.Module 5: Z-Transform(9 lectures)

Formation and solution of difference equations, definition and properties of Z- Transform, its inversion, relation with Laplace transform, application of Z-transform to solve difference equations with constant coefficient.

Text Book

1. B. S. Grewal, Higher Engineering Mathematics, Khanna publishwers 43rd edition (2015).
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

III Semester
Department of Electronics and Communication Engineering

Course Code : HUT256 **Course : Indian Traditional Knowledge**

L: 2 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 00**

Course Outcomes

Students will have increased ability to understand the importance and application of:

1. Indian Knowledge system and its scientific approach
2. Indian philosophical tradition
3. Indian artistic tradition
4. Traditional knowledge and protection of nature
5. The legality and its importance for the protection of Indian traditional knowledge

1. **Basic Structure of Indian Traditional Knowledge :** Vedas, Upavedas, Vedang, Upadang, scientific approach
2. **Ecology and Indian Traditional Knowledge :** Meaning, role, case studies
3. **Intellectual Property Rights and Indian traditional Knowledge :** Meaning, role in protection of Indian traditional knowledge, cases studies
4. **Indian Philosophical traditions:** Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches
5. **Indian Artistic Traditions:** Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, Nrityaevam Sahitya, case studies

Reference Material

1. RR Gaur, Rajeev Sangal, GP Bagaria, Human Values and Professional Ethics (Excel Books, New Delhi, 2010)
2. V. Sivaramakrishanan (ed.), Cultural Heritage of India – Course material,

BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014

3. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
4. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
5. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984
6. Pramod Chandra, Indian Arts, Howard University Press, 1984
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987

IV Semester
Department of Electronics and Communication Engineering

Course Code : ECT256 **Course : Analog and Digital Communication**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

Student should be able

1. To evaluate and compare various analog modulation schemes
2. To analyze the behavior of noise in communication system
3. To investigate digital modulation schemes
4. To analyze detection techniques in digital communication modulation systems

Course Outcomes

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

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

Unit I:

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Unit II

Noise in amplitude modulation systems, Noise in Frequency modulation systems, Pre- emphasis and De- emphasis, Threshold effect in angle modulation.

Unit III

Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Unit IV

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations, Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion

Unit V

Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

Unit VI

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation. Recent trends in modern communication systems

Text Books

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, "Modern Digital and Analog Communication Systems", Third Edition, Oxford University press.

Reference Books

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
2. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
5. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.
6. George Kenndey, 4th Edition , " Electronics Communication systems "

IV Semester
Department of Electronics and Communication Engineering

Course Code : ECP256 **Course : Analog and Digital Communication Lab**

Lab L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits : 01**

Course Objectives

1. To observe and interpret the performance of Analog Communication systems
2. To observe and interpret the performance of digital Communication systems
3. To explore communication software.

Course Outcomes

On completion of this Lab students will be able:

1. To observe and interpret the performance of AM modulator and demodulator under various changing parameters.
2. To understand FM Modulation and Demodulation.
3. To closely observe the effect of change of sampling frequency, duty cycle and order of filter in sampling and reconstruction.
4. To get the experience of working on software packages like MATLAB.

Experiments based on the following topics

- Amplitude Modulation
- Frequency Modulation
- Pulse Code Mudulation
- Delta Modualtion
- Adaptipe Delta Modualation
- TDM
- Communication Receiver
- Communication Software Study
- Digital Modulation Scheme

IV Semester
Department of Electronics and Communication Engineering

Course Code : ECT257 **Course : Analog Circuits**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

To make students aware about

1. Concepts related to frequency response of bipolar amplifiers at high frequency.
2. Use of feedback in amplifiers and oscillators
3. Fundamentals of Differential amplifier and various applications of op-amp
4. Concepts related to active filters and timer, used in analog circuits

Course Outcomes

1. To understand feedback amplifier and oscillator circuit using BJT
2. To understand the concepts of BJT at high frequency
3. To understand differential amplifier circuits and various applications of op-amp
4. To understand fundamentals of active filters & IC 555

Unit I

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Unit II

High frequency transistor models, frequency response of single stage and multistage amplifiers, various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Unit III

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc)Unit IV

Differential amplifier, DC and AC analysis, Constant current Bias circuits, Level shifting techniques, cascaded, differential amplifier stages

Unit V

OP-AMP and its applications: Block diagram of op-amp, Ideal and practical characteristics of Op-amp, Inverting and non-inverting amplifiers, integrator and differentiator, Adder and Subtractor amplifier, precision rectifier, Schmitt trigger.

Unit VI

Active filters: Design of Butterworth nth order filter – Low pass, high pass, band pass and band stop filters. Introduction to IC 555 and its application. Recent trends in analog circuits.

Text Books

1. Integrated Electronics: Millman, Halkias, Parikh TMH, 2 Edition
2. Electronic Devices and Circuit Theory: R. Boylestad, Pearson Education, 9 Edition
3. Design with Operational Amplifiers and Analog Integrated Circuits: Sergio Franco, TMH, 3 Edition
4. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.

Reference Books

1. A.S. Sedra and K.C. Smith, Microelectronic Circuits,
2. Electronic Devices and Circuits: David A. Bell, PHI. 4 Edition
3. Operational Amplifier: Ramakant Gaikwad.
4. Linear Integrated Circuits: D. Roy Choudhary, Shail Jain, New Age International.

IV Semester
Department of Electronics and Communication Engineering

Course Code : ECP257 | **Course : Analog Circuits Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week | **Total Credits : 01**

Course Objectives

1. To demonstrate frequency response of bipolar amplifiers at high frequency.
2. Analyze effect of feedback in an amplifier and oscillator.
3. Use op-amp to realize various circuits
4. Implement active filter and timer in the analog circuits

Course Outcomes

1. The students will be able to determine the frequency response of an amplifier.
2. The students will be able to design feedback and Oscillator circuits
3. To know the use of operational amplifier in various applications
4. To design Astable / Monostable multivibrator using IC 555.

Experiments based on following topics:

- RC coupled amplifier using BJT
- Feedback amplifier circuits
- Osclillator using BJT
- Linear and non linear Applications of OPAMP
- IC 555

IV Semester

Department of Electronics and Communication Engineering

Course Code : ECT258 **Course : Microprocessors**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

1. This course will make student aware of evolution of microprocessors and their advancement in recent time.
2. This course will impart the concept of assembly programming for real life problems.
3. This course will make student aware of hardware interfaces needed to develop a microcomputer system.
4. This course will prepare students to develop application based microcomputer system with optimum utilization of hardware resources and efficient programs.

Course Outcomes

1. To understand the organization of microprocessors in a microcomputer system.
2. To develop algorithms in assembly language codes for desired microprocessor.
3. To understand the hardware interfacing concepts of IO, memory and peripherals with microprocessors.
4. To interpret the advancements in microprocessor with recent trends and development.

Unit - I

Introduction to Intel s 8085 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing Modes & Instruction set of 8085.

Unit - II

Assembly language Programming and timing diagram of instructions. Concept of Interrupts and its structure in 8085 & Interrupt service routines. Memory interfacing/ mapping with 8085 (RAM/ROM/EPROM).

Unit - III

Architecture of 8255PPI and its interfacing with 8085, Interfacing of I/O devices like ADC, DAC, Stepper Motor, LEDs, 7-segment LED Displays using 8255.Unit IV

Introduction to 16 bit processor 8086, CPU architectures, Register set, flags, Memory organization, Signal Descriptions.

Unit - V

Instruction set, pseudo operations, assembler directives. Assembly language programming (MASM/TASM support). Stack concepts, Interrupts (hardware/software) and their routines.

Unit - VI

8086 Maximum mode system, Real and Virtual memory & protected mode. CPU Nomenclature and features: 286, 386, 486, Pentium.

Text Books

1. Microprocessor: Architecture, Programming & applications with 8085; Ramesh S.Gaonkar; Penramth International, 5 Edition.
2. Advanced Microprocessors and Peripherals; A. K. Ray & K. M. Bhurchandi; McGraw Hill, 3rd Edition.

Reference Books

1. 8085 Microprocessor: Programming and Interfacing; N. K. Srinath; PHI, 1 Edition.
2. Microcomputer systems: the 8086/8088 family: Architecture, Programming, and Design; Yu-chengnd Liu, Glenn A. Gibson; Prentice-Hall, 2 Edition.

IV Semester

Department of Electronics and Communication Engineering

Course Code : ECP258 **Course : Microprocessors Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs. Per week **Total Credits : 01**

Course Objectives

1. This course will make student aware of assembly language programming and its debugging techniques.
2. This course will make student aware of generic hardware interfaces needed to develop a microcomputer system.

Course Outcomes

1. To understand Assembly language programming for microprocessor 8085 and 8086.
2. To understand hardware interfacing with microprocessors and its programming.

Experiments based on following topics

- Assembly language programs based on logical and arithmetic instructions with 8085 microprocessor.
- Assembly language programs based on hardware interface modules with 8085 microprocessor.
- Algorithm development for 8086 microprocessor on MASM/TASM.

IV Semester
Department of Electronics and Communication Engineering

Course Code : ECT259 **Course : Probability Theory and Stochastic Processes**

L: 3 Hrs, T: 1 Hr, P: 0 Hrs. Per week **Total Credits : 04**

Course Objectives

1. To study probability theory and analyze random signals.
2. To interpret random process.
3. To apply techniques for analysis of random signals & processes.
4. To study the influence of random signal in LTI system.

Course Outcomes

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

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

Unit I

Introduction to probability, sets, fields, events, Axiomatic definition of probability, Joint, Conditional and Total Probabilities, Bayes theorem and applications.

Unit II

Introduction and Definition of a Continuous & Discrete Random Variables, Probability / Cumulative Distribution Function, Probability Density Functions, Conditional and joint distributions and densities, Functions of Random Variables. Moments of random variable.

Unit III

Expectation and introduction to estimation: Conditional Expectations, Moments. Markov and Chebyshev Inequalities. Characteristic functions of a random variable; Chernoff bounds.Unit IV

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

Unit V

Basic Definitions and Important Random Processes, Useful classifications of Random Processes. Stationary processes. Mean and covariance functions. Noises in communication system: Gaussian noise, white noise, colored noise

Unit VI

Introduction to LTI Systems. Transmission of random process through LTI system. Parseval s theorem for Energy & Power spectral density.

Text Books

1) A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes,'' Fourth Edition, McGraw Hill

2) H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education

3) S. Palaniammal, “Probability And Random Processes” PHI publication.

Reference Books

1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,

2) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers

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

IV Semester
Department of Electronics and Communication Engineering

Course Code : PHT251 **Course : Introduction to Electromagnetic Theory**

L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits : 03**

Course Outcomes

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

1. Define and recognize different coordinate systems to describe the spatial variations of the physical quantities dealt in electromagnetic field theory.
2. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media.
3. Understand the working principle of electromagnetic energy conversion and electromagnetic energy storage devices.
4. Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information thus creating a base for Microwave Engineering.

Module I:

Introductory Mathematical Preliminaries: Introduction to Cartesian, Cylindrical and Spherical coordinate systems, Divergence, Divergence Theorem.

Module II:

Time Invariant Electric Fields: Electric field intensity, flux density, Gauss s law& its Application, Electric potential and potential gradient, Materials in the Electric Field, Interface Conditions, Capacitance, Energy in the Electrostatic Field, Boundary Value Problems: Analytic Methods of Solution, Laplace & Poisson s equation.

Module III:

Time Invariant Magnetic Fields: Current density and continuity equation, Biot-Savart s law, Ampere s circuital law and applications, Magnetic flux and Flux density, Boundary conditions, Classification of Magnetic Materials

Module IV:

Introduction To Time-Varying Fields: Faraday's law in integral and differential form, Ohm's law, Lenz's law, electromotive force (emf) and work, inductance (mutual and self), displacement current.

Module V:

Maxwell's Equations: Maxwell s equations for steady fields, Maxwell s equations for time varying fields. Interface Conditions for the Electromagnetic Field, Electromagnetic wave equation, wave propagation in free space, in a perfect dielectric and perfect conductor, skin effect, Scalar and Vector magnetic potentials.

Module VI:

Electromagnetic Waves: Poynting vector, Poynting theorem, reflection and refraction of uniform plane wave at normal incidence plane, reflection at oblique incident angle, polarization.

Text Books

1. Field and Wave Electromagnetics: David Cheng, Pearson India, 2nd Edition, 2014

Reference Books

1. Fundamentals of Applied Electromagnetics: Fawwaz T. Ulaby, Umberto Ravaioli, Pearson India, 6thedition, 2014.
2. Engineering Electromagnetics: Nathan Ida, Springer Science 2nd Edition, 2008.
3. Principles of Electromagnetics: Matthew N. O. Sadiku, 6th edition.
4. Engineering Electromagnetics: William Hayt, John. R. Buck, Mc-Graw Hill Education, India, 8th Edition.
5. Electromagnetic Waves and Radiating Systems: Edward C. Jordan, Keith G. Balmain, Pearson India, 2nd Edition 2015.
6. Electromagnetics with Applications: John Kraus, Mc-Graw Hill Education, India, 5th Edition, 1999.

IV Semester

Department of Electronics and Communication Engineering

Course Code : CHT252 **Course : Environmental Sciences**

L: 2Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 00**

Course Outcomes

On successful completion of the course, the students:

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual s outlook, so as to perceive our environmental issues correctly, using practical approach based on observations and self learning.
3. Will become conversant with recent waste management techniques such as E-wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Principle of contaminant behaviour and recent trends in environmental pollution control

I - Air pollution and its control techniques: (4 lectures)

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle. Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).

Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

II - Noise pollution and its control techniques: (2 lectures)

Introduction to noise pollution and its causes

Noise pollution control: Recent advances in noise pollution control and benefits.

III - Soil pollution and its control techniques: (5 lectures)

Soil pollution: Soil around us, Soil water characteristics, soil pollution.

Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming, constructed wetlands), and phytoremediation.

Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals

IV - Water pollution and its control techniques: (8 lectures)

Major sources of water pollution : Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplasticsTechniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal.

Case studies

Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

V - E-wastes (2 lectures)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

VI - Environmental Sustainability: Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability

Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification- its importance and implementation

VII - Different government initiatives (2 lectures)

National ambient air quality standard 2009, Swacch bharat abhiyan, National afforestation program and Act- 2016, National river conservation plan, Formation of National Green Tribunal

Books Suggested

1) Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2) B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3) P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann
4) D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd. Sultan Chand & Company
5) Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6) P.T. Anastas & J.C. Warner, Green Chemistry: Theory & practice, Oxford University Press
7) P. Thangavel & Sridevi, Environemental Sustainability: Role of Green technologies, Springer publications

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT351 **Course : Electromagnetic Waves**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Wave propagation in different media.
2. Radiation characteristics of an antenna

Course outcomes

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

1. Understand characteristics and wave propagation on transmission lines
2. Understand properties of uniform plane wave
3. Understand and analyze wave propagation in waveguides
4. Understand principle of radiation and radiation characteristics of an antenna

Unit - I

Transmission Lines : general solution (voltage and current on transmission line), propagation constant and characteristic impedance, infinite transmission line, wave distortion, distortion-less transmission line, standing waves, reflection coefficient and VSWR, impedance t ransformation on loss-less and low loss transmission line, power transfer on transmission line, Smith chart, applications of transmission lines: impedance matching, use of transmission line sections as circuit elements.

Unit - II

Uniform Plane Wave : Maxwell s equation and boundary condition, propagation of wave, Poincare's Sphere, wave propagation in conducting medium, power flow and Poynting vector, surface current and power loss in a conductor

Unit - III

Plane waves at a media interface : plane wave in arbitrary direction, reflection and refraction at dielectric interface, total internal reflection, wave polarization at media interface, reflection from a conducting boundary.

Unit IV

Parallel Plane Waveguide : wave propagation in parallel plane wave guide, analysis of wave guide general approach, phase and group velocity modal propagation in waveguide, surface currents on the waveguide walls, field visualization, attenuation in waveguide, wave impedance.

Unit - V

Rectangular Waveguide : wave propagation in rectangular plane waveguide, analysis of waveguide general approach, modal propagation in waveguide, field visualization.

Unit - VI

Radiation : concept of radiation, radiation pattern, near and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, solution for potential function, radiation from the Hertz dipole, power radiated, receiving antenna, monopole and dipole antenna, Friis transmission equation.

Text Books

1. Electromagnetic Waves & Radiating Systems: Edward C. Jordan, Keith G. Balman, Prentice Hall
2. Electromagnetic Waves: R.K. Shevgaonkar, Tata McGraw Hill India
3. Antenna Wave Propagation: K.D. Prasad

Reference Books

1. Modern Antenna Design: Thomas Milligan, Wiley Interscience , IEEE Press
2. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall
3. Electromagnetics:David Cheng, Prentice Hall
4. Principles of Electromagnetics: Matthew N. O. Sadiku

V Semester

Department of Electronics and Communication Engineering

Course Code : ECP351 **Course : Electromagnetic Waves Lab**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Objectives

The objective of the course is to make students capable to:

1. Analyze wave propagation and its properties
2. Simulate and interpret antenna characteristics

Course outcomes

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

1. Predict nature and characteristics of wave propagation on transmission lines
2. Understand properties of uniform plane wave
3. Understand characteristics of wave propagating in waveguides
4. Understand radiation characteristics of an antenna

Experiments based on following topics

- Transmission line
- Wave propagation in different media
- Wave propagation in waveguide
- Radiation pattern of monopole and dipole antenna

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT352 **Course : Control Systems**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The course aims at:

1. Making students aware of various aspects and need of control systems.
2. Equipping students to represent, understand and analyze various types of control systems.

Course Outcomes

On completion of this course students will demonstrate ability to:

1. Find the transfer function of the system using block diagrams reduction technique, signal flow graphs.
2. Understand and perform time and frequency response analysis and techniques of compensation for improving the system response.
3. Apply various tools to determine the stability of the systems.
4. Understand State Variable method of Analysis for control system.
5. Understand Non-linear system and its analysis.

Unit - I

Introduction to need for automation and automatic control, use of feedback, Board spectrum of system application. Transfer Functions, block diagram, signal flow graphs, analysis of parameter variation, Control system components.

Unit - II

Time response of system, Types and order of system, Standard input, concept of gain and time constants, Steady State error, Time response specifications, approximate methods for higher order system, Introduction to controllers.

Unit - III

Stability of control systems, conditions of stability, characteristic equation, Routh's – Hurwitz criterion, special cases for determining relative stability. Root location and its effect on time response, Elementary idea of Root Locus, effect of adding pole and zero and proximity of imaginary axis.Unit IV

Frequency response method of analyzing linear system. Nyquist and Bode plot, Nyquist criterion, Stability and accuracy analysis from frequency response, frequency response analysis of Operational Amplifier.

Unit - V

State variable method of analysis: characteristic of system state, choice of state representation of vector matrix different equation, standard form, relation between transfer function and state variable.

Unit - VI

Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, Nonlinear system – Basic concept & analysis.

Text Books

1. Control systems Engineering: I. J. Nagrath and M. Gopal, 5th Edition, New Age International Limited, Publishers (Formerly Wiley Eastern Limited)
2. Modern Control Engineering: Katsihiko Ogata -3e - Prentice -Hall of India

Reference Books

1. Introduction to Feedback Control: Li Qui and Kemin Zhou, Pearson Education.
2. Control Systems – Principles and Design: M. Gopal, 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT353 **Course : Microcontrollers and Interfacing**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is:

1. To make students aware of evolution of microcontrollers and their advancement in recent time.
2. To inculcate skills needed to develop an embedded system.

Course Outcomes

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

1. Demonstrate assembly language programming for microcontroller.
2. Demonstrate interfacing of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop embedded systems using microcontrollers
4. Evaluate RISC processors and design ARM microcontroller based systems

Unit - I

Introduction to microcontroller Intel 8051 architecture, functional pin diagram and its description, Organization of internal RAM, ROM and register banks, organization SFR and flags, Ports functionality.

Unit - II

Addressing modes, Instruction set of 8051, Organization of hardware interrupt structure, Vector interrupt table, External memory interfacing, and basic assembly/Embedded C language programming concepts with examples for various software routines.

Unit - III

Counters and timers, serial data communication, input/output devices interfacing and application development with microcontroller using keyboards, LEDs, LCD displays, pulse measurements, D/A and A/D conversions, stepper motor.

Unit - IV

ARM Processor architecture : Register Set, Modes of operation and overview of Instructions and software routine development.

Unit - V

Interrupts and Device Drivers : Exceptions and Interrupt handling Schemes –Context & Periods for Context Switching, Deadline & interrupt latency.

Unit - VI

Basic Concepts of RTOS, Hard and Soft Real Time Systems, Tasks –periodic and aperiodic tasks, Timing parameters –release time, execution time, deadline, period, Basic real time Task Scheduling Algorithms, Resource Contention, Deadlocks, Priority Inversion, Basics of Re-entrancy and Thread Safety in Embedded Software Development.

Text Books

1. Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely „The 8051 Micro Controller and Embedded Systems , PHI Pearson Education, 5th Indian reprint, 2003.
2. Embedded Microcomputer Systems, Real Time Interfacing –Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.
3. ARM System Developer s GuideDesigning and OptimizingSystem Software - Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann Publishers.

Reference Books

1. Real Time Systems – Design for distributed Embedded Applications: Herma K.Kluwer Academic.
2. Operating Systems – A Design Oriented approach: Charles Crowley, McGraw Hill.
3. The 8051 Microcontroller – Architecture, Programming and Applications – Kenneth J. Ayala, West Publishing Company.
4. ARM Architecture Reference Manual, David Seal, Adison Wesley Publication.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECP353 **Course : Microcontrollers and Interfacing Lab**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Objectives

The objective of this course is:

1. To understand requirements of an embedded application and associated peripherals.
2. To inculcate programming skills needed to develop an embedded system.

Course outcomes

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

1. Know about the memory structures of microcontroller through different programs.
2. Organize logic for complex programs.
3. Handle interrupts related to microcontrollers.
4. Carry out interfacing of different peripherals.

Experiments based on following topics

- Programs based on timers
- programs based on serial communication
- programs based on memory accessing
- Programs based on interrupts.
- Programs based on interfacing of peripheral devices like ADC, DAC, LCD, Keyboard, LEDs, Stepper motor.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT354 **Course : Digital Signal Processing**

L: 3Hrs, T: 1Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The Objective of this course is to make students aware of:

1. Various transforms for implementation of DSP applications.
2. Characteristics and design of various types of digital filters.
3. DSP processor architecture.

Course outcomes

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

1. Use DFT and FFT algorithms for various DSP applications.
2. Design IIR and FIR digital filters along with its realization (Structures).
3. Design multirate signal processing systems and its applications.
4. Use suitable DSP processor for DSP applications.

Unit - I

Discrete Fourier Transform (DFT), Properties of DFT, Inverse Discrete Fourier Transform (IDFT), Circular Convolution using DFT/IDFT, Use of DFT in linear filtering. Fast Fourier Transform (FFT) Algorithms.

Unit - II

Structures for realization of LTI discrete-time systems in z domain: IIR systems: Direct Form-I, Direct Form-II, Cascade form and parallel form. FIR systems: Direct form, cascade form and linear phase realization.

Unit - III

Design of discrete time IIR filters from continuous time filters, IIR filter design by Impulse Invariant method, IIR filter design by the Bilinear Transformation, Butterworth filters, Chebyshev filters.Unit IV

Magnitude and phase response of Digital filters, Frequency Response of Linear phase FIR Filters, Design techniques for FIR filters, Design of FIR filters by windowing method – Hamming and Kaiser.

Unit - V

Multirate signal processing, Sampling Rate Conversion, Decimation, Interpolation, Multistage Decimators and Interpolators design, Applications of multirate signal processing such as subband coding, digital filter banks, QMF filter banks.

Unit - VI

DSP processor memory Architecture, Some examples of DSP Processors, Overview of TMS320 Family DSP processors.

Text Books

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.
3. Salivahanan, Digital Signal Processing, Tata McGraw Hill.

Reference Books

1. S. K. Mitra, Digital Signal Processing: A computer based approach. TMH
2. Jonathan Stein, Digital Signal Processing, Wiley India Ltd.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECP354 **Course : Digital Signal Processing Lab**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Objectives

The Objective of this course is to make students aware of:

1. Analysis of various discrete signals.
2. Design verification of digital filters and its implementation using DSP Processor.

Course outcomes

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

1. Find DFT of given discrete signals, circular convolution, FFT using MATLAB.
2. Design IIR and FIR digital filters along with its realization (Structures).
3. Design multirate signal processing systems such as decimators, Interpolators etc.
4. Use DSP starter kit (processor) for DSP applications.

Experiments based on following topics

- To find DFT, IDFT of given discrete signals.
- To find circular convolution by DFT-IDFT method.
- To find FFT of given discrete signals.
- Designing Structures for realization of LTI discrete-time systems in z domain.
- Design of IIR filters.
- Design of FIR filters.
- Design of decimators.
- Design of Interpolators.
- Study and experimentation with DSP processor kit.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT355-1 **Course : Information Theory and Coding**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Programme Elective - I)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Concepts of Information Theory.
2. Applying coding techniques in communication sources and channels.

Course Outcomes

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon s theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

Prerequisite – Probability Theory and Stochastic Processes (ECT259)

Unit - I

Introduction to Information Theory, Concept of information, entropy, conditional and joint entropies, mutual information, information rate. Source coding: Markov sources, Huffman codes, Kraft„s inequality, coding efficiency and redundancy.

Unit - II

Shannon's noisy coding theorem and converse for discrete channels, channel capacity, calculation of channel capacity and bounds for discrete channels, application to continuous channels, redundancy and efficiency of binary symmetric channel (BSC).Unit III

Codes for error detection and correction, parity check coding, linear block codes, error detecting and correcting capabilities, generator and parity check matrices.

Unit - IV

Perfect codes, Hamming codes, encoding and decoding Cyclic codes, polynomial and matrix descriptions, generation of cyclic codes, decoding of cyclic codes BCH codes, Construction and decoding, Reed Solomon codes.

Unit - V

Convolutional Codes – encoding – time and frequency domain approaches, State Tree & Trellis diagrams – transfer function and minimum free distance .

Unit - VI

Maximum likelihood decoding of convolutional codes – The Viterbi Algorithm, Sequential decoding.

Text Books

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

Reference Books

1. R.B. Ash, Information Theory, Prentice Hall, 1970.
2. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT355-2 **Course : CMOS Design (Programme Elective - I)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. CAD issues and manufacturing process
2. System design using CMOS technology

Course Outcomes

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

1. Understand designing of different CMOS circuits along with their circuit layout.
2. Have introduction to tools for VLSI IC design.
3. Use CMOS technology to design combinational and sequential circuits.

Prerequisites – Electronic Devices (ECT251), Analog Circuits (ECT257).

Unit - I

VLSI Design Flow, Introduction to MOS Transistors, Non Ideal I-V Behavior, DC Transfer Characteristics, MOS Transistor as a switch.

Unit - II

Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts.

Unit - III

Circuit Characterization and Performance Estimation: Introduction, Resistance Estimation Capacitance Estimation, CMOS gate transistor sizing, Driving Large capacitive loads, Scaling of MOS transistors.

Unit - IV

Layout Design Rules, CMOS process Enhancement: Interconnect, power, CAD and Manufacturing Issues: DRC, Circuit Extraction and Robustness.

Unit - V

Designing combinational logic gates in CMOS: Static Design Models, Ratioed Logic, Pass-Transistor Logic, Dynamic CMOS Design, Issues in Dynamic Design, Domino Logic, dual rail logic.

Unit - VI

Sequential MOS Logic Circuits: Introduction, Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch & Flip-Flop Circuit, CMOS D-Latch & Edge-Triggered Flip-Flop.

Text Books

1. N. H. E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. J. Rabaey, Digital Integrated Circuits : A Design Perspective, Prentice Hall India, 1997.

Reference Books

1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979
2. P. Douglas, VHDL : programming by example, McGraw Hill,2013.
3. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.
4. N. H. E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design: A System Perspective.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT355-3 **Course : Wireless Communication (Programme Elective - I)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of the course is to prepare the students:

1. To study basic concepts of wireless technologies
2. To study recent wireless communication systems

Course Outcomes

On completion of this course students will be able to:

1. Understand the working principles of the mobile communication systems.
2. Analyze mobile communication systems for improved performance
3. Understand multiple access techniques as well as modulation schemes for wireless environment
4. Understand fundamentals of GSM and next generation wireless systems

Prerequisites –Analog and Digital Communication, Probability Theory and Stochastic Processes

Unit – I

The Cellular Concepts: Architecture of mobile communication systems, call processing, cellular concepts, Frequency reuse, channel assignment, Hand of strategies interference & system capacity, improving grade of service & capacity in cellular systems.

Unit – II

Mobile Radio Propagation: Large scale path loss, free space propagation model, propagation effects such as reflection, diffraction, scattering, Link Budget Design using path loss models, Multipath fading

Unit – III

Modulation Techniques in Mobile Communication: Modulation Techniques: Review of binary modulation methods; ASK, PSK and FSK; Quadrature modulation methods QPSK, QAM, MSK, GMSK, Diversity Techniques: fundamentals of equalization, space, frequency and time diversity

Unit – IV

Multiple Access Techniques: Narrow band and Wide band systems, FDMA, TDMA, Space Division Multiple access – SDMA, FHMA, CDMA and other hybrid techniques.

Unit – V

GSM- Global System for Mobile: Services, Features, Architecture, GSM Radio Subsystem, GSM Channel Types, Frame Structure, Signal Processing and Call Setup in GSM

Unit – VI

Introduction to Recent Trends in Wireless Communication: Features of OFDM, OFDMA, LTE, NOMA, MIMO, Massive MIMO

Text Books

1) Wireless Communication – Principles and practice: T S. Rappaport, Prentice Hall PTR, 2nd edition, 2007

2) Mobile Communications – Design fundamentals: William C. Y. Lee, John Willey, 2nd Edition, 2010

Reference Books

1) Wireless digital communication: Kamilo Feher, Prentice Hall

2) Mobile Cellular Communication: W. C. Y. Lee, Mc Graw Hill

3) The Mobile Radio Propagation channel: J.D. Parson, Wiley, 2nd edition

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT355-T **Course : Smart Sensor (Programme Elective - I)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to provide students with:

1. The fundamentals of smart sensors.
2. The knowledge of selecting the right sensor for a given application.

Course Outcomes

Upon completion of this course, students will demonstrate the ability to:

1. Employ the knowledge of mathematics, science, and engineering to understand fundamentals of Smart sensor systems.
2. Appreciate and understand the applications of sensors.
3. Comprehend actuating devices for sensor systems.

Unit - I

Sensor Characteristics : Transfer function, accuracy, calibration, hysteresis, nonlinearity, saturation, repeatability, dead band, resolution, output impedance, excitation, dynamic characteristics, environmental factors, reliability and application characteristics.

Unit - II

Review of transducers for various parameters like temperature, pressure, flow, level, humidity, acceleration, vibration etc.

Unit - III

Sensors fabrication : Design considerations and selection criterion as per standards, Sensor fabrication techniques, process details, and latest trends in sensor fabrication.

Unit - IV

Smart sensors : Fundamentals, IEEE 1451 standard for smart sensors, Sensor Signals and Systems, Sensor specifications, Sensor Characteristics, Physical principles of sensing,Unit-V

Sensor Materials and overview of sensor technologies: Silicon as Sensing Material, Plastics, Metals, Ceramics, Glasses, Optical Glasses, Nanomaterials. Overview of Surface Processing technologies.

Unit - VI

Applications of Smart Sensors, Fiber optic sensors (Optical sensor), Accelerometer, Chemical sensors, biosensors, gas sensors, Industrial Application of Smart Sensors:Overview of automated consumer products: Smart Cars, Smart Homes, Smart Domestic Appliances, Smart Toys etc.

Text Books

1. D. V. S. Murty, "Transducers and Instrumentation", Second edition, PHI publication, Second edition, 2010.
2. Randy Frank, "Understanding Smart Sensors", Artech House Inc., 2nd Edition.
3. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Springer; 4th editon.

Reference Books

1. Gerard Meijer, "Smart sensor systems", Wiley, 2008
2. W Gopel, J. Hesse, J. N. Zemel, "Sensors A Comprehensive Survey" Vol. 9, Wiley- VCH, 1995
3. S. M. Sze, "Semiconductor Sensors", Wiley-Interscience,1994

V Semester

Department of Electronics and Communication Engineering

Course Code : HUP357 **Course : Personality Development**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Outcomes

CO1: Students willlearn to interact effectively in society and at work.

CO2: Students will learn to apply strategies to communicate effectively.

CO3: Students will understand generic skillsand apply the strategies for better personality, employability, and professional success.

Syllabus

(List of Practicals)

1. Knowing yourself : Swot analysis (pre and post) and RBS Technique
2. Effective Communication: Verbal Communication and barriers (special reference to GD and PI)
3. Effective Communication : Non-verbal Communication
4. Negotiation skills
5. Interpersonal relations and group dynamics
6. Stress Management
7. Time management
8. Critical thinking and Problem Solving

Reference Books and Material

1. Barun K. Mitra, "Personality Development and Soft Skills", 2016, Oxford
2. Dr. K. Alex, "Soft Skills: Know Yourself & Know the World", 2009, S. Chand
3. E.N McGrath, "Basic Managerial Skills for all", 2009, PHI Learning
4. Harvard Business Review - https://hbr.org/2005/01/how-to-play-to-your-strengths
5. Meenakshi Raman and Sangeeta Sharma, "Technical Communication: Principles and Practice", 2015, Oxford University Press

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT356 **Course : Computer Architecture**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Functioning of computer systems.
2. Design of computer systems.

Course Outcomes

After completion of the course, student will be able to

1. Understand basic working principles of computer.
2. Analyze the performance of computers.
3. Know how computers are designed and built.
4. Understand issues affecting modern processors.

Unit - I

Basic Structure of Computers, Functional units, software performance issues, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines. Register level design- general characteristics, Register level combinational and sequential components, design methods. Processor level design- components, design techniques

Unit - II

Processor organization, Information representation, number formats. Multiplication & division algorithms, Multiplier & divider design, ALU design, Floating Point arithmetic, IEEE 754 floating point formats

Unit - III

Control Design, Instruction sequencing, Interpretation, Hardwired control-Design methods, and CPU control unit. Micro programmed Control- Basic concepts, minimizing microinstruction size, multiplier control unit. Micro programmed computers- CPU control unit.Unit IV

Memory organizations, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

Unit - V

System organization, Input-Output systems, Interrupt, DMA, Standard I/O interfaces

Unit - VI

Concept of parallel processing, Pipelining, Forms of parallel processing, inter connect network, RISC & CISC architecture, Introduction to GPU, Recent Trends/Developments.

Text Books

1. "Computer Architecture and Organization", Hayes J. P, PHI, Second edition / Third edition
2. "Computer Organisation", V. Carl Hammacher, Fifth Edition

Reference Books

1. "Computer System Architecture", M. M. Mano, Edition
2. "Structured Computer Organisation", A. S. Tanenbum, PHI, Third edition
3. "Computer Organization and Microprogramming", Y. Chu, II, Englewood Chiffs, N. J., Prentice Hall Edition
4. "Computer Organization and Programming", C.W.Gear, Mc Graw Hill, N. V. Edition

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT357 **Course : Computer Networks**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to prepare the students to:

1. Develop an understanding of the fundamental concepts of computer networking.
2. Become familiar with the basic taxonomy and terminology of the computer networking areas.
3. Understand various networking concepts and undertake advanced courses in computer networking.

Course Outcomes

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

1. Understand basics of computer networks and reference models.
2. Analyze multiple access control techniques as well as switching, and routing techniques used in Computer Networks.
3. Understand error control, flow control and Congestion Control techniques.
4. Analyze various standards and protocols used in different layers of computer networks
5. Understand network security.

Unit - I

Introduction to computer networks and the Internet, Network types : LAN, MAN, WAN, Layered architecture, Reference models- OSI and TCP/IP, design issues for layers, protocols and standards.

Unit - II

Circuit Switching, Packet Switching : Virtual circuit and Datagram networks, Message Switching, connection oriented and connection less services, Connecting Devices: Switches, Bridges, routers, Transmission media, Multiple Access Resolution.Unit III

Data Link Control- Framing, Error Control and Flow Control : sliding Window Protocols, LAN standards IEEE 802. WAN technologies - ATM and SONET

Unit - IV

Network Layer: IP Addressing: IPv4, IPv6, Routing Algorithm, Internetworking.

Unit - V

Transport layer protocols, Congestion control and Quality of Service in transport layer.

Application Layer: The Web and Hyper Text Transfer Protocol, File transfer, Domain name system.

Unit - VI

Principles of cryptography, security and cryptography algorithms, authentication, key distribution and certification, symmetric key algorithm, public key algorithm, digital signature, management of public keys, communication security, email security.

Text Books

1. Forouzan, " Data Communications and Networking", Tata McGraw Hill, 4th Edition
2. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition

Reference Books

1. Andrew Tanenbaum, " Computer networks", Prentice Hall
2. William Stallings, " Data and computer communications" , Prentice Hall
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
5. S. Keshav, " An Engineering Approach to Computer Networking" , Pearson Education

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECP357 **Course : Computer Networks Lab**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Objectives

The objective of this course is to make students aware of:

1. Various Networking devices, tools and Protocols
2. Simulation and implementation of Computer Networks.

Course Outcomes

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

1. Implement networking concepts like server, client and addressing mechanism.
2. Effectively use networking tools in Computer Communication Network
3. Establish peer to peer as well as Local Area Network connectivity
4. Demonstrate various cables and connectors used for networking
5. Configure different devices like routers, host machines for setting up a network

Experiments based on following topics:

- Simulate & configure different types of networks using network stimulation tools.
- Configure different devices like routers, host machines for setting up a network
- Networking concepts like client-Server and addressing mechanism
- Static and Dynamic Routing

VI Semester

Department of Electronics and Communication Engineering

Course Code : CST364 **Course : Object Oriented Data Structure**

L: 2Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 02**

Course Outcomes

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

1. Understand principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Understand object oriented features like Abstraction, Encapsulation, Inheritance and Polymorphism.
3. Understand basic data structure and algorithms
4. Understand implementation and application of various data structures such as stacks, queues and Linked List.

Pre-requisite:

1) CST151 (Programming for Problem Solving)

Unit - I

Introduction to Object Oriented Programming : Procedural Language vs Object Oriented Language, Features of Java, basic data types and Operators in Java, Control Statements, Access Specifiers, arrays in Java, Naming Conventions, Creating and importing packages.

Unit - II

Classes and Objects : Class, Member functions, Constructors, static members, instantiating a class, constructor and method overloading, Object as a variable, object as an argument, object arrays.

Unit - III

Features of Object Oriented Programming : Abstraction, Encapsulation, Inheritance and Polymorphism. Inheritance: methods of derivation, super and final keyword, run time polymorphism, abstract class, interface, implementation of interface.

Unit - IV

Introduction to Data Structures : Elementary data organization, Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh Notation, Abstract Data Types (ADT), Arrays: Definition, Single & Multidimensional arrays, representations – row-major and column-major, operations – and their complexity.

Unit - V

Stacks : Primitive Stack operations: Push & Pop, Prefix and Postfix Expressions evaluation using stack. Queues: Concept of Queue, Operations on Queue: Insert, Add, Delete, Full and Empty, Circular Queue, Doubly Ended Queue.

Unit - VI

Linked List : Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. time and space complexity of these operations. Doubly Linked Lists: operations and algorithmic analysis

Text Books

1. Programming with Java, E. Balaguruswamy, Tata McGraw Hill publication.
2. Data Structures Schaum s Outlines: Seymour Lipschutz, Tata McGraw Hill publication

Reference Books

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. D. Samanta; Classic Data Structure; PHI Publications; 2004

VI Semester

Department of Electronics and Communication Engineering

Course Code : CSP364 **Course : Object Oriented Data Structure Lab**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

Course Outcomes

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

1. Apply principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Implement object oriented features like Encapsulation, Inheritance and Polymorphism.
3. Implement data structures such as stacks, queues and Linked List and apply them to solve common computer science problems.

Pre-requisite

1) CST151 (Programming for Problem Solving)

Practicals based on above CST364 syllabus

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECP358 **Course : Mini Project/Electronic Design Workshop**

L: 0Hrs, T: 0Hr, P: 4Hrs. Per week **Total Credits : 02**

Course Objectives

The objective of the course is to make students aware of:

1. Testing and troubleshooting of electronic system.
2. Aspects of design & fabrication of Hardware/Product.

Course Outcomes

On completion of this laboratory students will be able to:

1. Select proper components as per the mini project requirement.
2. Assemble various components on breadboard and test the circuit.
3. Use controller/processor IC for their project and develop program either in assembly or C language using Integrated Development Environment.
4. Design PCB layout using CAD tools and fabricate it on copper clad board.

Exploration of the following topics (but not limited to)

1. Identification of Electronic Components and Testing.
2. Datasheet interpretation.
3. Fabrication and testing of small electronics circuit.
4. PCB Design and its testing.
5. Study of Indian standards in electronic industry.
6. Manufacturing practices in Electronic Industry.
7. Microcontroller based mini project.
8. Technical Report presentation.

Reference Books/Website

1. Electronic Component and Materials: Dr. Madhuri Joshi
2. Printed Circuit Boards – Design and Technology: Walter Bosshart, McGraw Hill Education.
3. Integrated circuit Fabrication Technology: David J. Elliott, Tata McGraw Hill.

   www.electronicstds.gov.in
4. www.deity.gov.in (Department of Electronics and Information Technology, Ministry of Communication and IT, Government of India)

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT359-1 | **Course : Speech and Audio Processing**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Program Elective - II)**

Total Credits : 03

Course Objectives

The objective of this course is to provide students with understanding of:

1. Fundamentals of speech and audio processing.
2. Analyze various techniques for speech and audio processing in communication systems

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

Prerequisites – Signals and Systems (ECT253), Digital Signal Processing (ECT354)

UNIT - I

Digital speech processing and its applications, production and classification of speech sounds, lossless tube models, digital models for speech signals; Analysis and synthesis of pole-zero speech models, Levinson recursion, lattice synthesis filter.

UNIT - II

Time dependent processing of speech, pitch period estimation, frequency domain pitch estimation; Discrete-time short-time Fourier transform and its application, phase vocoder, channel vocoder.

UNIT - III

Homomorphic speech processing, waveform coders, hybrid coders and vector quantization of speech; Model based coding: Linear predictive, RELP, MELP, CELP; Speech synthesis.

UNIT - IV

Principles of speech recognition, spectral distance measures, dynamic time warping, word recognition using phoneme units, hidden Markov models and word recognition, speech recognition systems, speaker recognition.

UNIT - V

Ear physiology, psychoacoustics, perception model and auditory system as filter bank; Filter bank design and modified discrete cosine transform algorithm for audio compression in MP3 and AAC coders; Standards for high-fidelity audio coding.

UNIT - VI

Tree-structured filter banks, multicomplementary filter banks; Properties of wavelets and scaling functions, wavelet transform; Filter banks and wavelets, applications of wavelet signal processing in audio and speech coding.

Text Books

1. L. R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education.
2. Douglas O"Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000.
3. L. R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.

Reference Books:

1. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Edition., PE.
2. Ben Gold & Nelson Morgan, "Speech & Audio Signal Processing", 1st Edition, Wiley

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT359-2 **Course : Introduction to MEMS**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Program Elective - II)**

Total Credits : 03

Course Objectives

The objective of this course is to make student aware of:

1. Evolution of MEMS and their advancement in recent time.
2. Concept of designing, modeling and fabrication of MEMS devices.

Course Outcomes

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

1. Appreciate the underlying working principles of MEMS and NEMS sensors, Actuators used in micro systems.
2. Understand the basic principles and applications of micro-fabrication processes
3. Understand the basics of device design and modeling
4. Understand the applications of RF MEMS devices and Physical micro sensors

Prerequisites – Electronic Devices (ECT251)

Unit - I

Introduction to MEMS: Historical background, Scaling effects, Benefits of Miniaturization, Micro/Nano Sensors, Actuators and Systems overview: Case studies.

Unit - II

Types of MEMS: Optical MEMS, Bio- MEMS, RF- MEMS, Micro fluidics

Unit - III

MEMS fabrication modules: Oxidation, Deposition, Lithography, Etching. Micromachining, Wafer Bonding, recent trends.

Unit - IV

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes s law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems, modeling based on case study of a device.

Unit - V

RF MEMS Devices : Capacitor, Inductor, Switches, Resonators, and antennas, RF MEMS components in communications, space and defense applications.

Unit - VI

Physical Micro sensors : Classification of physical sensors, Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors.

Text Books

1. G. K. Anantha suresh, K. J.Vinoy, S .Gopalkrishnan K. N. Bhat, V. K. Aatre, Microand Smart Systems, Wiley India,2012.
2. S. E. Lyshevski, Nano-andMicro-Electromechanical systems: Fundamentals of Nano-and Micro engineering (Vol.8) .CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRCPress,1997.

Reference Book

1. G.Kovacs, Micro machined Transducers Source book, McGraw-Hill, Boston,1998.
2. M.H.Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, NewYork,2000.

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT359-3 **Course : Biomedical Electronics**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Program Elective - II)**

Total Credits : 03

Course Objectives

The objective of this course is to prepare the students to learn the components of man instrument system and principles of operation of basic medical electronics equipment.

Course Outcomes

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

1. Understand the application of electronic systems in biological and medical applications.
2. Understand the practical aspects of bio potential measurements.
3. Understand and analyze the medical imaging systems.
4. Understand electrical safety hazards and precautions in medical instruments.

Unit - I

Brief review of human physiology. Components of man instrument system, Biomedical transducers and sensors, Physiological system of the Body, cells & their structure, Resting & Action Potential(Generation & Propagation), The heart & cardiovascular system, Basic structure of Heart.

Unit - II

Bio potential measurements: Electrode theory, types of electrodes, Bio signals characteristics – frequency and amplitude ranges. ECG –Einthoven„s triangle, standard 12 lead system, Principles of vector cardiography. Pace Makers, types of pacing modes, power sources in Pacemaker, types of Defibrillators, Methods of stimulation, and types of stimulators

Unit - III

Introduction to: Electroencephalography (EEG), Electromyography, (EMG), Electroretinography (ERG) and Electroculogram (EOG). Biotelemetry system, Radio telemetry system, Problems in implant telemetry.

Unit - IV

Measurement of blood temperature, pressure and flow, X-Ray and nuclear imaging, Angiography, Radiation therapy, Ultra sonic Imaging systems, Echocardiography, Tomography, Principles of computer assisted tomography, MRI

UNIT - V

Patient monitoring systems : Intensive care operating room, Ambulatory patient monitoring.

Unit - VI

Electrical safety : Physiological effects of electricity, Micro & Macro shock hazards, precaution, Ventilators, heart-Lung machine, artificial kidney.

Text Books

1. Leslie Cromwell, - Biomedical Instrumentation and measurement||, 2nd edition, hall of India, New Delhi, 2015.
2. Khandpur R.S, - Handbook of Biomedical Instrumentation||, 3rd edition, Tata McGra Hill New Delhi, 2014

Reference Books

1. W. F. Ganong, Review of Medical Physiology, 8thAsianEd, Medical Publishers,1977.
2. J. G. Websster, ed., Medical Instrumentation, Houghton Mifflin,1978.
3. A. M. Cookand J. G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall,1982.

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT359-4 **Course : Introduction to IoT**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Program Elective - II)**

Total Credits : 03

Course Objectives

The objective of this course is to prepare the students To learn the concept of Internet of Things (IoT) and its applications.

Course Outcomes

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

1. Understand the scope of IoT.
2. Explore the linux environment for SBC (Single Borad Computer)
3. Demonstrate IoT based applications on Raspberry Pi
4. Use Python-based IDE and trace and debug Python code on the Raspberry Pi for IoT applications.

Prerequisites – Programming for Problem Solving (CST151/CSP151)

Unit - I

Introduction to Internet of Things : Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit - II

Exploring the platforms/ hardware for IoT : Getting Started with Raspberry Pi, Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Over-clocking, Component overview.

Project 1: Use your Pi as a desktop PC

Unit - III

Introduction to Linux : Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Project 2: Compilation and Installation of Libraries and packages (GPIO, I2C UART, etc)

Unit - IV

Programming the Raspberry Pi: Python: Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Project 3: Basic Scripting using Python-based

Project 4: Applications using Python packages

Unit - V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity, etc) for IoT, Wired and Wireless communication, Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library,

Project 5: Set up a Pi ADC/DAC

Project 6: Sensor Interfacing to Pi

Communication Using Raspberry Pi for IoT applications : Wired and Wireless communication, TCP IP configurations, SSH, Putty Terminal usage, Web page applications using Python.

Project 6: Hosting and representation of sensor data on web page

Project 7: Case study and Implementation of Real World application

Unit - VI

Applications of IoT : case studies based on Commercial products, Applications / Product Development of IoT based application

Project 8: Development of any Standalone application

Text Books

1. Designing the Internet of Things, Adrian McEween and Hakim Cassimally, 1st Edition JohnW i l e y and Sons, Ltd.

Reference Books

1. Learning of Internet of Things, Peter Waher, 1st Edition Packet Publishing.
2. Raspberry Pi 3 : An Introduction to Using with Python Scratch, Javascript and more, Gary Mitnick, Create Space Independent Publishing Platform, 2017.
3. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
4. Raspberry Pi User Guide, Eben Upton and Gareth Half acreee, John Wiley & Sons, 2016

VI Semester

Department of Electronics and Communication Engineering

Course Code : IDT353 **Course : Biology for Engineers**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to:

1. Make engineering students conversant with basic Biology regarding the life processes.
2. Impart knowledge about the common corridors of biology and engineering as biologically inspired technologies like bioenergetics, bioprocesses, biomaterials etc.
3. Introduce study of technical topics such as Biosensors, transducers, amplifiers and signal processing with an objective of appreciating engineering principles in biological systems.

Course Outcomes

Upon the completion of this course students will be able to

1. Understand the basics of biology regarding the life structures and process.
2. Comprehend Bio molecules and Enzymes as basic building block of all forms of life
3. Understand the principles of energy transaction in living systems.
4. Identify DNA as a genetic material in the molecular basis of information transfer
5. Realize generation of bioelectric signals and understand fundaments of Biosensors and devices.

Unit - I

Engineering perspective of Biological Sciences, Fundamental differences between science and Engineering- case studies; Hierarchy and classification of life forms, Levels of organization of life- cell, tissues, organs, system and organism, Anatomy and physiology.

Unit - II

Bio molecules and Enzymes : Bio molecules as basic building block of all forms of life, structure and function of carbohydrates ,proteins and Amino acids, Lipids, Nucleic acids ,Vitamins and Minerals, Enzymology- Introduction ,classification and mechanism of actionUnit-III:

Metabolism /Bioenergetics : Fundamental principles of energy transactions (Thermo dynamics) as applied to biology, Entropy changes in biological systems, free energy, equilibrium, process of synthesis and breakdown of glucose.

Unit - IV

Genetics: Introduction to Genetics, genetic codes, Expression and Transmission of genetic Information, concept of DNA cloning, single gene disorders in humans.

Unit - V

Bioelectric signals and devices : Resting and action potential, propagation of bioelectric signals, various bioelectric signals- ECG, EEG, EMG.

Unit - VI

Biosensors – Introduction to Biosensors, transducers, amplifiers.

Overview of Bio imaging : Brief introduction to medical imaging and different medical Imaging modalities, Electro Physiological Signal Analysis. Diagnostic Devices- Overview of Radiography, Nuclear Medical Imaging, Ultrasound Imaging.Therapeutic Devices- Overview of Diagnostic application of LASERs, High frequency heat therapy, Automatic Drug delivery Systems.

Text Book

1. Biology: A Global Approach: Campbell, N. A.; Reece, J. B; Urry, Lisa; Cain, M, L; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Eggins BR. (1006) Biosensors: An Introduction. John Wiley & Sons Publishers.

Reference Books

1. Molecular Cell Biology. W. H. Freeman.: Lodish H, Berk A, Zipursky SL, et al. (2000)
2. Principles of Biochemistry.:Lehninger,A.L.,Nelson,D.L., & Cox, M. M (2000). Newyork; Worth Publishers
3. Genes VII: Lewin B.(2000). Oxford University Press. th
4. Medical Instrumentation Application and Design :John G. Webster, ,4 edition, Wiley India,2015
5. Biology for Engineers by G. K. Suraishkumar, Oxford University Press, 1st Ed.,

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECP360 **Course : Comprehensive Viva**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 01**

- The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the field of Electronics and Communication Engineering.
- The viva shall normally cover the courses taught in all the preceding semesters.
- The viva will test the student s learning and understanding about the courses learned.
- The main objective of this course is to prepare the students to face interview both in the academic and the industrial sector.
- Every student will be required to undergo comprehensive viva-voce at the end of 6th semester

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT451-1 **Course : Embedded Systems (Elective - III)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Embedded System Software development, testing & Verification.
2. Skill set required for Design and Development of the Embedded System Hardware (Interface / Peripherals) and Software for Embedded Applications / Product in the Industry.

Course Outcomes

After completion of this course, the students will be able to:

1. Get hands on exposure to the tool Chain utilized in Embedded System Design, Development & Verification.
2. Configure and Program the Controller for interfacing with different Modules / Devices.
3. Develop Embedded Application using Embedded C Programming.
4. Implement various Embedded Wired/Wireless Communication Protocols.

Prerequisites: - Microcontrollers and Interfacing (ECT353)

Unit – I : Introduction to Embedded System

Design Considerations for Embedded Systems, Evolution of ARM Microcontrollers in Embedded systems. Embedded System Development Process - Tool Chain and Cross Compilation: Text Editors/Compilers/Programmers/ Development tools/IDE, Debugger.

Unit – II : ARM Cortex M Processor Core

Introduction to ARM Cortex - M microcontroller and STM32L4 architecture, Programmers Model, Processor Operating States, instruction set, clock configuration etc. Why learn assembly language / Embedded C.

Unit – III : Embedded C Programming

Introduction to Embedded C programming, Storage Classes, Data Types, Controlling program flow, Arrays, Functions, Memory Management, Pointers, Arrays and Pointers, Pointer to Functions and advanced topics on Pointers, Structures and Unions, Data Structures, Linked List, Stacks, Queues, Conditional Compilation, Preprocessor directives, Variable arguments in Functions, bitwise operations and typecasting.

Unit – IV : ARM Cortex Peripherals

ARM Cortex–M (STM32L4) Peripherals GPIOs, Timers / Counter, PWM, Interrupt handling and its programming examples (Timer Based PWM output, System timer (Sys Tick), demonstrating race conditions, booting process, volatile variables etc.)

Unit – V : Floating Point Unit

Fixed point computation, need for Floating point Unit (FPU), Coprocessor Access control (CPAC) in System Control Block (SCB).

Unit – VI : Interfacing using Embedded Wired /Wireless Communication Protocols

GPIO based interfacing like LED, Joystick, LCD driver, ADC, Sensors following I2C, SPI, CAN Bus, GSM etc protocols.

Text Books

1. Embedded Systems with ARM Cortex-M Microcontrollersin Assembly Language and C, Dr. Yeifeng Zhu. ISBN-13: 978-0-9826926-6-0. Publisher: E-Man Press LLC

Reference Books

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, Dr. Alexander G. Dean ISBN: 978-1-911531-03-6.
2. The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach, Trevor Martin. ISBN-13: 978-0080982960.
3. The Definitive Guide to the ARM Cortex- M0, M3 & M4, Joseph Hiu. ISBN-13: 978-1856179638.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT451-2 **Course : Microwave Theory and Techniques**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Elective - III)**

Total Credits : 03

Course Objectives

The Objective of this course is to make students aware of:

1. Different Communication Bands in Microwave Spectrum.
2. Active and Passive Microwave devices and their characteristics.
3. Basic of radar systems.

Course Outcomes

After completion of this course, the students will be able to:

1. Identify different communication bands in Microwave Spectrum.
2. Understand RF and Microwave networks and able to do the analysis.
3. Analyze the characteristics microwave components with the help of scattering matrix.
4. Understand basic radar systems.

Prerequisites: - Electromagnetic Waves (ECT351), Analog and Digital Communication (ECT256)

Unit – I

Introduction to Microwaves- History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/EMC.

Unit – II

Analysis of RF and Microwave Transmission Lines – Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Microstrip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.Unit –III:

Passive and Active Microwave Devices-Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, PIN diodes, Microwave Tubes: Klystron, TWT, Magnetron.

Unit – IV

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas-Antenna parameters, Planar Antennas, Antenna for ground based systems, Antennas for air borne and satellite borne systems.

Unit – V

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal. Measurement of Microwave antenna parameters.

Unit – VI

Applications of Microwave Engineering – Radar block diagram, Radar range equation, CW & FM Modulated radar, MTI & Pulse Doppler Radar, Tracking Radar, Radar Receivers, Radar antenna.

Text Books

1. Microwave Circuits, R. E. Collins, McGraw Hill.
2. Microwave Circuits, K. C. Gupta and I. J. Bahl, Artech house.

Reference Books

1. Microwave device and circuits: Samuel Y. Lio, 3 Edition, PHI.
2. Introduction of radar systems: Skolilik, McGraw hill.
3. Microwave theory and measurement: G. Lance.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT451-3 **Course : Digital Image and Video Processing**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Elective - III)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Multimedia data (image, video).
2. Mathematical framework to describe and analyze images and videos and associated processing.
3. The techniques for its enhancement and representation.
4. Various image and video compression standards.

Course Outcomes

After completion of this course, the students will be able to:

1. Apply fundamentals of image processing for transformation and enhancement.
2. Apply compression techniques to image.
3. Understand fundamentals of video, motion and optic flow.
4. Implement and develop image and video processing method.

Prerequisites: - Signals and Systems (ECT253), Digital Signal Processing (ECT354)

Unit – I

Fundamentals of Image processing and Image Transforms : Basic steps of Image processing system sampling and quantization of an Image –Basic relationship between pixels, color images, RGB, HSI and other models.

Unit – II

Image Transforms : 2 –D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Sine Transform (DST), Discrete Wavelet transforms.

Unit – III

Image Processing Techniques: Image Enhancement, Spatial Domain methods- Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods- Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation- Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.

Unit – IV

Image Compression : Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models- Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Unit – V

Digital Video Sampling, Video Frame classifications, I, P and B frames, Notation, ITU-RBT 601Digital Video formats, Digital video quality measure. Video Capture and display: Principle of color video camera, video camera, digital video. Sampling of video Signals: Required sampling rates, sampling in two dimensions and three dimensions, progressive Vs. interlaced scans.

Unit – VI

2-D Motion Estimation : Optical flow, general methodologies, Pixel based motion estimation-Regularization using motion smoothing constraints, using multipoint neighborhood. Block Matching Algorithms- Exhaustive block matching algorithms, phase correlation method, Binary feature matching. Multi resolution Motion Estimation-General formulation, Hierarchical blocks matching Algorithms.

Text Books

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya –quin Zhang, "Video processing and communication ",1st edition , PHI

Reference Books

1. Willam K. Pratt "Digital Image Processing" 3rd Edition, John Willey & Sons
2. M. Tekalp ,"Digital video Processing", Prentice Hall International
3. J. W. Woods, Multidimensional Signal, Image and Video Processing and Coding. Aca-demic Press, 2nd edition – 2012
4. Milan Sonka, Vaclan Hlavac, "Image Processing Analysis , and Machine Vision", 3rd Edition, CENGAGE, 2008

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT452-1 **Course : Optical Fiber Communication**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Elective - IV)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Optical fiber system and transmission techniques.
2. Optical fiber sources and detectors
3. Optical fiber measurement systems.

Course Outcomes

After completion of this course, the students will be able to:

1. Understand the principles of fiber-optic communication, the components and the bandwidth advantages.
2. Understand operation of lasers, LEDs and detectors.
3. Analyze system performance of optical communication systems.
4. Understand design considerations of Optical Networks.

Prerequisites : Electronics Devices (ECT251), Analog and Digital Communication (ECT256), Electromagnetic Waves (ECT351)

Unit – I

Introduction to Optical Fiber : Principle of optical fiber communication, Advantages and applications, Ray model, Total internal reflection phenomenon, Acceptance angle, acceptance cone, Numerical aperture. Structures and characteristics of various fibers such as step index, graded index, Single mode and multi mode fibers, Meridional and skew rays.

Unit – II

Fiber Splicing techniques, Fiber Joints and Couplers. Signal degradation in fibers – Coupling Loss – Intrinsic Coupling loss and Extrinsic Coupling loss, Attenuation - Absorption losses, bending losses, scattering losses. Dispersion – intermodal dispersion, intramodal dispersion.Unit–III:

Optical Sources : LED -Structures and properties, Types of LED, LED Power and quantum efficiency. LASER – Principle of operation, Fabry-Perot laser and its properties.

Unit – IV

Optical Receivers : Photo detector – PIN diode, Structures and Properties, Avalanche Photo-detectors, Structures and Properties, Quantum efficiency, responsivity

Unit – V

Optical Fiber Measurements : Fiber Numerical Aperture measurements, Bending Loss measurements, Fiber attenuation measurements, Fiber optics cutoff wavelength measurements, Field measurements.

Unit – VI

Optical Networks : System design consideration, Point – to –Point link design, Link power budget, rise time budget, WDM, Passive DWDM, Components, Elements of optical networks, SONET/SDH. Optical Interfaces, SONET/SDH Rings and Networks, High speed light wave Links, OADM configuration, Optical ETHERNET-Solution.

Text Books

1. Optical fiber communication, principles and practice: John M. Senior, PHI
2. Optical fiber communication: B. Keiser, Tata Mc-Graw Hill

Reference Books

1. Optical communication system: J. Gower, PHI.
2. Optical Fiber System : Kao, Tata Mc Graw Hill

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT452-2 | **Course : Broadban Communication**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Elective - IV)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Basic concepts related to satellite Communication and applications.
2. Sub-Systems of Satellites and Launches.
3. The parameters affecting the Satellite System Performance and link design.

Course Outcomes

After completion of this course, the students will be able to:

1. Understand the various aspects of broadband ISDN services.
2. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
3. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
4. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

Prerequisites:- Analog and Digital Communication (ECT256)

Unit - I

Broadband-ISDN Services and Protocol

B-ISDN protocols : User plane, management plane, control plane, signaling plane, other aspects of B-ISDN: Broadcast service aspects, Network aspects and user network interface aspects, SONET- An overview.

Unit - II

Introduction to Satellite Communication : Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Unit - III

Orbital Mechanics : Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Unit - IV

Satellite sub-systems : Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit - V

Typical Phenomena in Satellite Communication : Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift, Satellite link budget.

Unit - VI

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Text Books

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002

Reference Books

1. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
2. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT452-3 | **Course : Wireless Sensor Network**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Elective - IV)**

Total Credits : 03

Course Objectives

The objective of this course is to:

1. Impart fundamental concepts about wireless sensor networks
2. Understand protocols in wireless sensor networks

Course Outcomes

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

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

Prerequisite: - Wireless Communication (ECT 355-3)

Unit - I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Unit - II

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks.

Unit - III

Routing protocols, MAC protocols : Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,Unit – IV:

Dissemination protocol for large sensor network, Data dissemination, data gathering and data fusion, Quality of a sensor network, Real-time traffic support and security protocols.

Unit - V

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Unit – VI

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text Books

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009

Reference Books

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
3. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT453-1 | **Course : Error Correcting Codes**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Elective - V)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. The principles and applications of information theory in communication systems.
2. The theoretical framework upon which error-control codes are built.
3. Aspects of error control codes used in communication systems.

Course Outcomes

After completion of this course, the students will be able to:

1. Learn the fundamentals of Information Theory
2. Understand the importance of error correction methods in data communication and storage.
3. Develop an ability to compare and contrast the strengths and weaknesses of various errors correcting code for a given application.
4. Demonstrate competence in analyzing and evaluating the practice of different error correcting coded in digital communication system.

Prerequisites : Analog and Digital Communication (ECT256)

Unit – I

Information Theory: Mathematical model of Information, A Logarithmic measure of information, average and mutual information and entropy, types of errors, error control strategies, channel capacity, redundancy and efficiency of channels, discrete channels, Shannon theorem

Unit – II

Block Codes : Introduction to block codes, single parity check codes, product codes, repetition codes, hamming codes, syndrome and error detection, minimum distance of a block code, error-detecting and error-correcting capabilities of a block code, standard array and syndrome decoding, minimum distance of block codes, soft - decision decoding, automatic repeat request schemes, applications of block codes for error control in data storage system

Unit – III

Cyclic Codes : Definition of cyclic codes, polynomials, generator polynomials, encoding cyclic codes, decoding cyclic codes, generator and parity-check matrices of cyclic codes, syndrome computation and error detection, decoding, cyclic hamming codes, shortened cyclic codes, error-trapping decoding for cyclic codes, dual cyclic codes.

Unit – IV

Convolutional Codes : Encoding and state, tree and trellis diagrams, maximum likelihood decoding of convolution codes -Viterbi algorithm, sequential decoding -stack algorithm, interleaving techniques – block and convolutional interleaving, ARQ – types of ARQ, performance of ARQ, probability of error and throughput.

Unit – V

BCH Codes : Linear Algebra, Galois Field, definition and construction of binary BCH Codes, error syndromes in finite fields, Reed- Solomon Codes.

Unit – VI

Turbo Codes : LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

Text Books

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J. Costello, Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill

Reference Books

1. R. Togneri, C.J.S deSilva, Fundamentals of Information Theory and Coding Design, Taylor and Francis
2. Error Correcting Coding Theory-Man Young Rhee-1989, McGraw – Hill Publishing, 19
3. Digital Communications- John G. Proakis, 5th ed., 2008, TMH.
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K. Moon, 2006, Wiley India.
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.
6. F.J. Mc Williams and N. J. A. Slone, The Theory of Error Correcting Codes, 1977.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT453-2 **Course : Long-Term Evolution Technologies**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Elective - V)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. The basics of LTE standardization phases and specifications.
2. The system architecture of LTE
3. The layer of LTE based on the use of OFDMA and SC-FDMA principles.
4. The basic operations of Air interface in a LTE 4G system

Course Outcomes

After completion of this course, student will be able to

1. Understand basic architecture of LTE
2. Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth.
3. Learn LTE Standard and Radio Resource Management
4. Learn advanced LTE structure

Prerequisites : Analog and Digital Communication (ECT256), Wireless Communication (ECT355 – 3)

Unit - I

Key Enablers for LTE features : OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependant Multiuser Resource Scheduling, Multiantenna Techniques, IP based Flat network Architecture, LTE Network Architecture.

Unit - II

Multi-Carrier Modulation : Multicarrier concepts, OFDM Basics, OFDM in LTE, Timing and Frequency Synchronization, Peak to Average Ratio, Multiple Antenna Transmission and Reception:

Unit - III

LTE - 4G OFDMA and SC-FDMA : Multiple Access for OFDM Systems, OFDMA, SCFDMA, Multiuser Diversity and Opportunistic Scheduling, OFDMA and SC-FDMA in LTE, OFDMA system Design Considerations.

Unit - IV

The LTE Standard : Hierarchical Channel Structure of LTE, Downlink OFDMA Radio Resources, Uplink SC-FDMA Radio

Unit - V

Radio Resource Management and Mobility Management : PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination

Unit - VI

LTE Advanced : Introduction, Requirements, Main Features, Backward Compatibility, Deployment Aspects, UE Categories for LTE Advanced.

Text Books

1. Fundamentals of LTE" Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Pearson education (Formerly Prentice Hall, Communications Engg and Emerging Technologies), ISBN-13: 978-0-13-703311-9.
2. LTE for UMTS Evolution to LTE-Advanced" Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003

Reference Books

1. Jeffrey. G, Andrews, Arunabha Ghosh and Rias Muhamed, "Fundamentals of WiMAX: Understanding Broadband Wireless Networking", Pearson Education, 2007.
2. Yan Zhang and Hsiao-Hwa Chen, "Mobile WiMAX : toward broadband wireless metropolitan area networks",Auerbach Publications, 2007
3. Moray Rumney, "LTE and Evolution to 4G Wireless: Design and Measurement Challenges", Agilent Technologies, 2008.
4. StefaniaSesia, IssamToufik, Matthew Baker, "LTE – The UMTS Long Term Evolution: From Theory to Practice", John Wiley & Sons, 2e, 2011.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT453-3 **Course : Machine Learning (Elective - V)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Mathematical foundations needed for machine learning
2. Python programming skills required to build machine learning applications.

Course Outcomes

After Completion of this course, the students will be able to:

1. Demonstrate understanding of the mathematical foundations needed for machine learning.
2. Collect, explore, clean and manipulate data.
3. Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering.
4. Build machine learning applications using Python based toolkits.

Prerequisites : Probability Theory and Stochastic Processes (ECT259), Object Oriented Data Structure (CST364), Object Oriented Data Structure Lab (CSP364)

Unit - I

Introduction to Probability : Probabilities of events, random variables, joint distribution & densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

Unit - II

Introduction to Python toolkits : Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots. Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Unit - III

Overview of Machine learning concepts : Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization. Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning,

Unit - IV

Classification and Regression Algorithms : Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest and their classification Errors.

Unit - V

Clustering : sequential clustering, hierarchical clustering, probabilistic clustering, partitional clustering, clustering for region segmentation, Introduction to Neural Networks, back-propagation algorithm, Overview of Deep Learning.

Unit - VI

Case Studies of Machine Learning Application : Weather forecasting, Stock market prediction, Object Detection and recognition, Real Time Applications.

Text Books

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
2. Jeeva Jose, “Machine Learning”, Khanna Publishing House, Delhi.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press http://www.deeplearningbook.org
2. Chopra Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media

VII Semester

Department of Electronics and Communication Engineering

Course Code : HUT452 **Course : Engineering Economics**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objective

The course aims to equip engineering students to understand the core concepts of Economics in order to bring efficiency in engineering projects/endeavours.

Course Outcomes

After Completion of this course, the students will be able to:

1. Understand the basic concepts of engineering economics.
2. Evaluate the strategic role of engineers in business and engineering economic decision making
3. Understand revenue and cost concepts in different market structure for better decision- making.
4. Evaluate various forces impacting price and output in difference market.
5. Review the elements of financial statements.
6. Discuss and interpret the role and functioning of financial institutions and markets.

Unit - I

Foundation of Engineering Economics : Definition of Economics, basic concepts of Economics (value, goods, wealth, income, savings, utility); definition and scope of engineering economics; demand and supply: Laws and elasticity.

Unit - II

Engineering Economic decision : Rational decision-making process, Engineer s role in business, types of strategic engineering economic decisions, fundamental principles in engineering economics, methods to evaluate business and engineering projects (the teacher can take up one method from the text book).

Unit - III

Cost and Revenues : Revenue concepts: Marginal Revenue, Average revenue, operating and non-operating revenue; Cost concepts: Marginal cost, Average cost, Sunk cost, Opportunity cost, Recurring cost, Non-recurring cost, Incremental cost, Cash cost, Book costs, life cycle cost, direct and indirect costs, Application of the concepts in business/industry.

Unit - IV

Market and Pricing : Types of markets, price and output determination, Industry equilibrium; Inflation: types, causes, inflation adjusted decisions; Break-even analysis, Index numbers.

Unit - V

Basic Accounting : Balance sheet, Income Statement, Ratio analysis, Depreciation.

Unit - VI

Financial institutions and Market : Financial institutions: Regulatory, Banking, NBFIs and NBSFOs; Financial markets: Call Money, Treasury Bills, Bond, Stock, Derivatives.

Text Books

1. Panneer selvam. R., (2020) Engineering Economics,PHI learning, private limited, Delhi, 2nded.
2. Park.C., (2018) Fundamentals of Engineering Economics, Pearson India Education Services, Pvt. Ltd, 3rd ed.
3. Dewett.K.K. (2006), Modern Economic Theory, S. Chand, New Delhi, 2006.
4. Bhole, L.M. and JitendraMahakund (2017), Financial Institutions and Markets, Tata McGraw Hill (2007) 6thed.
5. Chandra, Prasanna (2008) Financial Management: Theory and Practise, Tata MacGraw Hill Publishing Company Limited, New Delhi

Reference Books

1. Ahuja H.L., (2017) Managerial Economics, Analysis of managerial Decision making, S. Chand and company Limited, New Delhi, 9thed.
2. Dwivedi, D.N., Managerial Economics, Vikas Publishing House Pvt. Ltd, Nodia (2015) 8thed.
3. Peterson, H. Craig and Lewis, W.Chis. & Jain. Sudhir K., Managerial Economics. Prentice Hall of India (2008) 4th ed.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECP454 **Course : Industry Internship Evaluation (6-8 Weeks)**

L: 0Hrs, T: 0Hr, P: 2Hrs. Per week **Total Credits : 00**

- Students admitted in B.E. Semester-I during 2018-19 and thereafter (or admitted laterally in Sem-III during 2019-20 and thereafter) are required to complete minimum six week internship in industry/research organization/IIT/IISc/IIIT/NIT/In-house research internship at RCOEM during the winter/summer vacations prior to the commencement of Semester-VII as per scheme.
- This internship scheme shall be offered subject to fulfillment of selection criteria by the student as decided by the department, grant of permission by industry /organization where internship is to be carried out, approval by head of department.
- On completion, the student has to submit the internship report/s and internship completion certificate/s issued by the organization(s) where it was completed, to the department.
- The department will evaluate the same by way of Seminar/Viva-voce etc in the department in Semester-VII as an Audit Course. Student shall be required to secure Satisfactory 'SF' grade in it.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECP455 **Course : Project Stage - I**

L: 0Hrs, T: 0Hr, P: 10Hrs. Per week **Total Credits : 05**

Course Objectives

The objectives of Project Stage- I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, involving theoretical and practical work to be assigned by the Department to group of f o u r students, under the guidance of a Supervisor.

Course Outcomes

1. Students will be able to apply the Engineering knowledge gained to analyze, formulate and provide solutions to Electronics & communication based Engineering problems.
2. Students will get acquaintance of Simulation Software
3. Leadership and team Spirit will be inculcated
4. Students will be able to justify their project idea/concept through effective presentation skills.

The students will carry out following tasks for Project Phase – I

1. Survey and study of published literature on the assigned topic
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting Analysis/Simulation/Experiment/Design/Feasibility
4. Preparing a Written Report on the Study conducted for presentation to the department
5. Final Seminar, as oral Presentation before a departmental committee

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT456-1 **Course : Robotics (Elective - VI)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Foundation of Robotics and its applications
2. Robotics control and design.
3. Vision based Robotic systems

Course Outcomes

After the completion of this course, the students will be able to:

1. Understand kinematic and dynamic analyses with simulation.
2. Design control laws for a robot.
3. Select a robotic system for a given application.
4. Create a prototype robotic system.

Prerequisites : Engineering Mathematics (MAT255), Control Systems (ECT352)

Unit - I

Introduction to Robotics : Types and components of a robot, Classification of robots, closed- loop and open-loop control systems, Kinematics systems, Definition of mechanisms and manipulators, Social issues and safety.

Unit- II

Robot Kinematics and Dynamics : Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics Dynamic Modelling: Equations of motion: Euler-Lagrange formulationUnit –III:

Sensors and Vision System : Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations, Vision applications in robotics.

Unit - IV

Robot Control : Basics of control: Transfer functions, Control laws: P, PD, PID Non-linear and advanced controls

Unit - V

Robot Actuation Systems : Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit - VI

Control Hardware and Interfacing : Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications

Text Books

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.

Reference Books

1. Craig, J.J., "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi, 2009
2. Steve Heath, "Embedded System Design", 2 nd Edition, Newnes, Burlington, 2003
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006
4. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi.
5. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modelling and Control", John Wiley and Sons Inc, 2005
6. Steve Heath, "Embedded System Design", 2 nd Edition, Newnes, Burlington, 2003
7. Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, "Intelligent Mechatronic System: Modeling, Control and Diagnosis", Springer.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT456-2 **Course : Computer Vision (Elective - VI)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. Fundamental concepts of Computer Vision and Image Processing.
2. Applications of computer vision.

Course Outcomes

After the completion of this course, the students will be able to:

1. Understand the concepts related to Image formation and processing
2. Learn various computer vision algorithms, methods and concepts.
3. Learn fundamentals of Machine Learning.
4. Implement computer vision algorithms with emphasis on applications and problem solving.

Prerequisites : Engineering Mathematics (MAT255), Probability Theory and Stochastic Processes (ECT259).

Unit - I

Introduction to Computer Vision and Basic Concepts of Image Formation : Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.

Unit - II

Fundamental Concepts of Image Formation : Radiometry, Geometric Transformations, Geometric Camera Models, Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.

Unit - III

Image Processing Concepts : Pre-processing concepts, Basics of Color image processing: Color fundamentals, color models, color transformation, color segmentation, smoothing, and sharpening.

Unit - IV:

Image Descriptors and Features : Texture Descriptors, Color Features, Edges/Boundaries. Object Boundary and Shape Representations. Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency.

Unit - V

Fundamentals of Machine Learning : Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis

Unit - VI

Applications of Computer Vision : Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoder, Machine Learning Algorithms and their Applications and case studies.

Text Books

1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

Reference Books

1. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer.

VII Semester

Department of Electronics and Communication Engineering

Course Code : ECT456-3 **Course : Antenna Theory (Elective - VI)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objectives

The objective of this course is to make students aware of:

1. The concepts of radiation from conductor, reflector, broadband, microstrip and array antenna.
2. The concepts of smart antennas.

Course Outcomes

After completion of this course, the students will be able to:

1. Understand basic concepts and principles involved in radiation from different antennas.
2. Understand types, design, performance parameters and application of antennas.
3. Understand antennas array and its analysis.
4. Understand smart antenna.

Prerequisites : Introduction to Electromagnetic Theory (PHT251), Electromagnetic Waves (ECT351)

Unit - I

Fundamental Concepts Radiation from Wires and Loops : Concept of radiation and radiation pattern, radiation integrals and auxiliary potential functions, Infinitesimal dipole, finite-length dipole, dipoles for mobile communication, small circular loop.

Unit - II

Aperture and Reflector Antennas : Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, radiation from sectorial and pyramidal horns, design concepts, parabolic reflector and cassegrain antenna.

Unit - III

UHF and Broadband Antennas : Log-periodic and Yagi-Uda antennas, frequency independent antennas. Basic characteristics of micro strip antennas, feeding methods, patch antenna.

Unit - IV

Antenna Arrays : Introduction to antennas arrays, analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays.

Unit - V

Basic Concepts of Smart Antennas : Concept and benefits of smart antenna, types of smart antennas, sectorization, Direction-of-Arrival considerations, beam forming, impact of array configuration and geometry on radiation pattern, concept of adaptive antennas and adaptive array algorithm.

Unit - VI

Architecture of smart antenna systems, applications of smart Antenna, performance improvement, feasibility and system considerations, motivation and basic MIMO antenna system.

Text Books

1. J. D. Kraus, Antennas, McGraw Hill, 2nd edition.
2. C. A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 3rd edition.

Reference Books

1. Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas, Morgan & Claypool Publishers.
2. R. E. Collin, Antennas and Radio Wave Propagation, McGraw Hill.
3. R. C. Johnson and H. Jasik, Antenna Engineering Handbook, 3rd edition, McGraw Hill.
4. I. J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House.
5. R. K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill.
6. Ahmed El Zooghby, Smart Antenna Engineering, Artech House.
7. Sun, Chen, Cheng, Jun, Ohira, Takashi, Handbook on Advancements in Smart Antenna Technologies for Wireless Networks.
8. Adaptive Antenna Arrays: Trends and Applications by Sathish Chandran.

VIII Semester

Department of Electronics and Communication Engineering

Course Code : ECT457-1 **Course : Real Time Operating System and Kernels**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Elective - VII)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. The Foundation of Real Time Operating Systems and its requirements.
2. The applications of Real Time Operating Systems using case studies.

Course Outcomes

After completion of this course, the students will be able to:

1. Understand Real-Time Operating Systems fundamentals
2. Select a RTOS for implementation on an embedded system for a particular application.
3. Understand the Concepts of Memory Management.
4. Analyze the case studies of different RTOS

Prerequisites : Computer Architecture (ECT356), Microcontroller and Interfacing (ECT353)

Unit - I : OS Overview

Computer System Structure, What is an Operating System (OS)? Function of OS, OS Interaction with Computer and User Programs Different Classes of OS, Operation of OS, Structure of OS. Process, Task and Thread: Processes and Programs, Programmer view of processes, Implementation of Processes, Interaction between Processes, Threads and its types.

Unit - II : Scheduling

Levels of Scheduling, Scheduling Algorithms: Non-pre-emptive Pre-emptive, Quantum Size, Priority, Performance Evaluation, Real Time Scheduling, Aperiodic RT scheduling. Concurrency Scheduling, Multiprocessing environment, Read-write by multiple CPUs and consistency problem Solutions with Mutual Exclusion, Hardware Mutex, Software Mutex Example: Dekker s algorithm, Use of Semaphore and preventing busy waiting Message passing and Mail box for communication, Deadlock and Solutions

Unit - III

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

Unit - IV : Memory Hierarchy and Virtual Memory

Cache and its types, Cache Policy.

Memory map, Memory management, Address binding and dynamic binding, Relocation register, Memory Partitioning. Virtual memory: Buddy memory and non-contiguous memory allocation, Paging, Translation Lookaside Buffer (TLB), Multilevel Page Table, Segmentation with Paging, Virtual memory :Paging and Handling Page Fault, Fetching and replacing Pages, Working Set Model, Virtual Memory and multiprogramming

Unit - V : File System and I/O

File structure and directory structure, File attributes Open Files, Allocation methods, Accessing a file, disk Disk and I/O scheduling, I/O, Direct control, Interrupt and DMA

Unit - VI : RTOS

Case Studies of RTOS RT Linux, MicroC/OS-II, VxWorks, Embedded Linux, and Tiny OS Structure of RTOS and RTOS Kernels architecture, Applications of RTOS, Task and Time Management, Data Sharing, Performance Evaluation and debugging

Text Books

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

Reference Books

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
2. Advanced UNIX Programming, Richard Stevens
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh

VIII Semester

Department of Electronics and Communication Engineering

Course Code : ECT457-2 | **Course : Adaptive Signal Processing**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Elective - VII)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Basic principles of adaptation - various adaptive signal processing algorithms.
2. Adaptive signal processing architectures and explain their use in real world applications.
3. Various applications - adaptive noise cancellation, interference cancellation, system identification, etc.

Course Outcomes

After the completion of this course, the students will be able to:

1. Understand the non-linear control and the need with significance of changing the control parameters w.r.t. real-time situation.
2. Understand the mathematical treatment for the modeling and design of the signal processing systems.
3. Understand various algorithms required for adaptive signal processing.
4. Design and implement filtering solutions for applications such as channel equalization, interference cancelling and prediction considering present day challenges.

Prerequisites : Signals and systems (ECT253), Digital signal processing (ECT354)

Unit - I

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit - II

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment.

Unit - III

Variants of the LMS algorithm : the sign LMS family, normalized LMS algorithm, blocks LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space

concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram- Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Unit - IV

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit - V

Introduction to recursive least squares (RLS) algorithm, vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Unit - VI

Implementation of Adaptive Filters : DSP microprocessor implementation; software; custom hardware. Applications of adaptive filtering: spectral estimation, system identification, noise cancelling, acoustic and line echo cancellation, channel equalization.

Text Books

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Reference Books

1. Kaluri V. Rangarao, Ranjan K. Mallik, "Digital Signal Processing: A Practitioner s Approach", ISBN: 978-0-470-01769-2, 210 pages, November 2006, John Wiley (UK)
2. S. Thomas Alexander, "Adaptive signal processing-Theory and Applications", 1986, Springer –Verlag.
3. Candy, "Signal analysis", McGraw Hill Int. Student Edition

VIII Semester

Department of Electronics and Communication Engineering

Course Code : ECT457-3 | **Course : Artificial Intelligence**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Elective - VII)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Foundation in Artificial Intelligence and its applications
2. Understanding of search and games algorithms
3. Exposure to optimization and inference algorithms for model learning

Course Outcomes

After the completion of this course, the students will be able to:

1. Build intelligent agents for search and games
2. Solve AI problems through programming language
3. Apply optimization and inference algorithms for model learning
4. Create agents to learn and act in a structured environment

Prerequisites : Probability Theory and Stochastic Processes (ECT259), Object Oriented Data Structure (CST364), Object Oriented Data Structure Lab (CSP364)

Unit - I

Introduction : Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

Unit - II

Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

Unit - III

Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.

Unit - IV:

Markov Decision Process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs

Unit - V

Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Unit - VI

Advanced Topics : Machine Learning Fundamentals, Neural Network Fundamentals, Deep Learning Fundamentals, Computer Vision Fundamentals. Future of AI.

Text Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

Reference Books

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

VIII Semester

Department of Electronics and Communication Engineering

Course Code : ECP458 **Course : Project Stage - II**

L: 0Hrs, T: 0Hr, P: 18Hrs. Per week **Total Credits : 09**

Course Objectives

The objectives of Project Stage- II is to enable the student to extend further the investigative study taken up under Project Stage- I, involving both theoretical and practical work, under the guidance of a Supervisor from the Department jointly with a Supervisor.

Course Outcomes

1. Students will be able to apply the Engineering knowledge gained to analyze, formulate and provide solutions to Electronics & communication based Engineering problems.
2. Students will get acquaintance of Simulation Software
3. Leadership and team spirit will be inculcated
4. Students will be able to justify their project work through effective presentation skills.

The students will carry out following tasks for Project Phase – II

1. In depth study of the topic assigned in the light of the Report prepared under Project Stage- I
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including team work
4. Detailed Analysis//Simulation/Design/Problem Solving/Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar Presentation before a Departmental Committee

VIII Semester

Department of Electronics and Communication Engineering

Course Code : ECP459 **Course : Full Semester Industry Internship**

L: 0Hrs, T: 0Hr, P: 0Hrs. Per week **(Six Months)**

Total Credits : 15

- The internship scheme will be available to undergraduate students of the department during the VIII Semester.
- This scheme will provide students to undergo internship with stream majors at industry/well known academic institutions /R&D Laboratory premises and earn real world exposure.
- The student will be relieved for his/her internship on the start of the VIII semester. Such students will appear for End Semester Examination along with other regular students of VIII semester as per the time-table provided by the institute.
- The evaluation will be done by industry mentor in coordination with the department. It will cover Program electives and Project work of VIII Semester.
- The head of department will assign a Mentor Faculty for a group comprising maximum four students each. The mentor faculty will also act as the Internal Supervisor for their respective projects in the industry.
- This internship scheme during VIII Semester shall be offered subject to fulfillment of selection criteria by the student as decided by the department, grant of permission by industry /organization where internship is to be carried out, approval by head of department, availability of faculty and other requirements/constraints if any.
- On selection, it will be mandatory for the student to abide by the guidelines issued by department and the industry regarding internship.
- On completion, the student has to submit the internship report/s and internship completion certificate/s issued by the organization(s) where it was completed, to the department.
- The department will evaluate the same by way of Seminar/Viva-voce etc. in the department during VIII Semester.

IV Semester

Department of Electronics and Communication Engineering

Course Code : ECT299-1 **Course : Renewable Energy (Open Elective - I)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 03**

Course Objective

The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

Course Outcomes

1. To Understand the Need, importance and scope of non conventional and alternate energy resources.
2. To understand role significance of solar energy.
3. To provide importance of Wind Energy.
4. To understand the role of ocean energy in the Energy Generation.
5. To get the utilization of Biogas plants and geothermal energy
6. To understand the concept of energy Conservation.

Unit - I : Solar Energy

Solar Radiation, Measurements of Solar Radiation, Flat Plate And Concentrating Collectors, Solar Direct Thermal Applications, Solar Thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

Unit - II : Wind Energy

Wind Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator.

Unit - III : Ocean Energy

Ocean Thermal Energy Conversion (OTEC), Principle of operation, development of OTEC plants, Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants.Unit IV: BIO-MASS

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gasdigesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Unit - V: Geothermal Energy

Resources, types of wells, methods of harnessing the energy, scope in India.

Unit - VI : Energy Conservation

Principles of energy conservation, the different energy conservation appliances, cooking stoves, Benefits of improved cooking stoves over the traditional cooking stoves

Text Books

1. Reneweble energy resources: Tiwari and ghosal, Narosa publication.
2. Non conventional Energy Sources,Khanna Publication

Reference Books

1. Renewable Energy Sources:Twidell& Weir, CRC Press.
2. Solar Energy/ S.P. Sukhatme, Tata McGraw-Hill.
3. Non Conventional Energy Systems: K M. Mittal, A H WheelerPublishing Co Ltd.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa publication.
5. Biomass Energy, Oxford &IBH Publication Co.

IV Semester

Department of Electronics and Communication Engineering

Course Code : ECT299-2 **Course : Evaluation in Communication Technologies**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Open Elective - I)**

Total Credits : 03

Course Objectives

The objective of this course is

1. To give students the knowledge of basics of telecommunication systems and its applications.
2. To give students the overview of function of optical fiber communication systems, Satellite communication system and its importance in telecommunications.
3. To give knowledge of various wireless standards used worldwide and concepts in mobile communications.

Course Outcomes

On completion of this course students will be able:

1. To acquire the fundamental concepts of Telecommunication Engineering.
2. To understand use of different modulation techniques used in Analog and Digital Communication.
3. To acquire basic knowledge of different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.
4. To Compare and contrast advantages and limitations of various Telecommunication systems.

Unit - I

Basics of Telecommunication Engineering

Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet etc.

Unit - II

Basic Elements of Telecommunication systems

General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

Unit - III

Introduction to Optical Fiber Communication

Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks etc.

Unit - IV

Introduction to Satellite Communication

Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

Unit - V

Some concepts in Wireless communications

Wireless Standards: Overview of 2G and 3G, 4G cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes- BPSK, QPSK.

GSM, Wi-Fi & Wi-Max, Bluetooth, Recent Trends/Developments.

Unit - VI

Basics of Mobile Communication

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control;

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation.

Antennas for mobile terminal- monopole antennas, base station antennas and arrays.

Text Books

1) Communication Electronics: Simon Haykin, 4th Edition, John Wiley Publication.

2) George Kenndey, 4th Edition , " Electronics Communication systems "

3) Digital Communication: John G. Proakis, Tata McGraw Hill

4) Satellite Communication : T . Prat, C.W. Bostian, Wielly Publication

Reference Books

1) Wireless communication – Principles and Practice: Theodore S. Rappaport, Pearson Education.

2) Optical Fiber Communication – Principles and Practice: John M. Senior, Pearson Education.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT398-1 | **Course : Electronics in Agriculture**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Open Elective - II)**

Total Credits : 03

Course Objectives

The objective of the course is to make students aware of:

1. Environmental issues in agricultural sector.
2. Electronics Engineering technologies and tools for Agricultural sector.

Course Outcomes

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

1. Develop and understand the role and responsibility of an engineer in agricultural sector.
2. Understand the importance of electrical and instrument technology for the benefits of agricultural development.
3. Understand the modern remote sensing technology for the agricultural development.
4. Understanding the diversity of precision farming and
5. Develop advanced agricultural technologies for digitization of Indian agronomy.

Unit - I

Role of engineering in agricultural sector, Professional responsibilities and professional ethics, engineering divisions in agricultural sector, Environmental issues, various government policies for research and development under agricultural engineering for productivity enhancement.

Unit - II

Use of electrical energy in agriculture, electromechanical energy conversion, Electrical motors, Selection of motors for different farming applications, renewable energy sources.

Unit - III

Instrument for measurement : pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content and soil moisture & temperature.Unit IV:

Remote Sensing and Application : Data acquisitions ystems, Test sites, Common measurements, Geologic investigations, Agriculture and Forestry investigations, Atmospheric investigation, visual image interpretation, digital image processing, Earth resource satellite .

Unit - V

Precision Farming : An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis, Computers and Geographic information systems, Precision farming-Issues and conditions, Role of electronics in farm machinery for precision farming.

Unit - VI

Advanced Agricultural Technologies : Difference between traditional and modern agricultural practices; Internet of Things (IoT), Online Marketing of agrobased products, Information and Communication Technology (ICT), Mobile Technology, Agricultural Drones & Robotics, Artificial Intelligence (AI) based farming.

Text Books and Reference Books

1. Bhatia, S.L. "Handbook of Electrical Engineering". Khanna Publications.
2. Bsown, R.H., "Farm Electrification". McGraw Hills, 1956.
3. Considine T..M. "Process/Industrial Instruments and Controls· Handbook", McGraw Hill 1993.
4. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. Lori J. Dhabalt, USA
5. Barret, E.C. and Curits, L.F. "Introduction to Environmental Remote Sensing". John Wiley and Sons Inc. New York, 1976.
6. Megh R. Goyal, “Emerging Technologies in Agricultural Engineering” Apple Academic Press.

V Semester

Department of Electronics and Communication Engineering

Course Code : ECT398-2 **Course : Sensors and Transducers**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week **(Open Elective - II)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Suitable instruments for Measurement.
2. Various sensors and transducers.

Course Outcomes

On completion of this course students will be able to:

1. Understand Errors in instrumentation system.
2. Learn Classification of Transducers based on their functionality.
3. Know different type of sensors.
4. Understand the applications of sensors and transducers.

Unit - I

General Configuration and Functional Description of measuring instruments : Block schematic of general instrumentation system (Analog and Digital), Static and Dynamic Characteristics of Instrumentation system, errors in instrumentation system, Standards and calibration, Active and Passive Transducers and their classification.

Unit - II

Motion Transducers : Resistive strain gauge, LVDT, Capacitive transducers, Piezo-electric transducers, vibrometers and accelerometers.

Temperature Transducers : Thermistor, RTD, Thermocouple and their characteristics. Piezoelectric Transducers: Piezoelectric phenomenon, Piezoelectric materials, Force, Strain, Torque, Pressure and Acceleration transducers.Unit III

Magnetostrictive Transducers : Magnetostriction phenomenon, Force, Torsion transducers, Hall Effect Transducers.

Electromechanical Transducers : Tachometers, Variable reluctance, Electrodynamic pressure, Electromagnetic flow meters.

Unit - IV

Photoelectric Transducers : Photoelectric phenomenon, Photoconductive, Photovoltaic, Photoemmisive.

Unit - V

Digital Transducers : Digital displacement transducer, Digital tachometers.

Unit - VI

Sensors : Proximity Devices, Bio-Sensors, Smart-Sensors, Piezo-electric Sensors, Recent Trends/Developements.

Text Books

1. Transducers and Instrumentation: Murty D.V. PHI, 10th print 2003
2. Mechanical and Industrial Measurements: Jain R.K.,Khanna Publ. 10th Edition- 4th reprint 2000
3. Electrical and Electronic Measurements and Instrumentation: Sawhney A. K., Dhanpat Rai and Sons.

Reference Books

1. Sensors and Transducers: Patranabis D., PHI, 2nd edition
2. Instrumentation Devices and Systems: Rangan C. S., Sharma G. R., Mani V. S. V., Tata McGraw Hill Publication Limited.
3. Instrumentation Measurement and Analysis: Nakra B. C., Chaudhary K. K., Tata McGraw Hill Publication Limited.

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT399-1 | **Course : Multimedia Communications**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Open Elective - III)**

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. Multimedia communications systems, application and basic principles
2. Analysis of the multimedia streaming communication systems

Course Outcomes

After learning this course student will be able to:

1. Describe technical characteristics and performance of multimedia system and terminals
2. Design creative approach in application of multimedia devices, equipment and systems
3. Interpret and analyze multimedia system and components
4. Describe applications of the multimedia systems

Unit - I

Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS application QoS.

Unit - II

Multimedia Information Representation : Introduction, digital principles, text, images, audio, video, Classification of the multimedia services.

Unit - III

Text And Image Compression : Introduction, compression principles, text compression, image compression, Structure of video content, video sequence, partition of picture.Unit IV:

Audio And Video Compression : Introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.

Unit - V

Multimedia Information Networks : Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol.

Unit - VI

The Internet : Introduction, IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8.

Text Books

1. Video Processing and Communications, by Yao Wang, Joern Ostermann, and Ya-Qin Zhang. Prentice Hall, 2001
2. Multimedia over IP and Wireless Networks: Compression, networking, and Systems, by Mihaela van der Schaar. And Philip Chou, Academic Press, 2007

Reference Books

1. Multimedia Systems, J.F.K, Buford, ACM Press, 1994
2. Understanding Networked Multimedia, Fluckiger, Prentice Hall
3. Compressed Video over Networks, edited by Ming-Ting Sun and Amy R. Reibman, Marcel Dekker Inc., Switzerland, 2000

VI Semester

Department of Electronics and Communication Engineering

Course Code : ECT399-2 **Course : Information and Communication Technologies in Rural Sector (Open Elective - III)**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week

Total Credits : 03

Course Objectives

The objective of this course is to make students aware of:

1. The need of development in rural sector.
2. Scope of Electronic Communication to develop the rural sector.

Course Outcomes

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

1. Analyze the scope of telephony & mobile communication in rural area.
2. Significance of Computer networks in rural area.
3. Provide smart things in the rural area.
4. Develop automation in the rural agriculture.
5. Know the role of Information technology for rural development.

Unit - I

Need of rural development, need of present world, the role of Electronic and Communication in the rural sector, Basic communication model, Line telephony, Line telegraphy, Facsimile exchange, Development of electronic telephone, Caller ID, WLL.

Unit - II

Cellular Telephone systems : Digital cellular telephone, Mobile communication system, Role of mobile communication, mobile hotspot and mobile applications related to rural development, GPS.

Unit - III

Computer communication network : Introduction to LAN, MAN, WAN, Intranet & Internet system, Role of Computer networks, broadband, ISDN, VSAT.

Unit - IV

Building infrastructures : Smart schools, Hospitals, Public Distribution System (PDS),ATM Systems, Smart Transport System, Geographic information system (GIS)

Unit - V

Agricultural infrastructure : Solar Pump Systems, , Google earth mechanism, Digital surveillance system, Soil health testing, Weather report, Radio & Television Broadcasting, Unmanned Arial Vehicles (UAV).

Unit - VI

Information Technology : e-Seva, eNAM (National Agriculture Market), Mahatma Gandhi National Rural Employment Guarantee Scheme, (MGNREGS), Digital India Land Records Modernization Program (DILRMP), BHARATNET – The world s largest rural broadband project.

Text Books

1. Telecommunication Switching systems & Networks: Vishwanathan, 3rd Edition, PHI.
2. Wireless Communication – Principles and practice: T S. Rappaport, Prentice Hall PTR, 2 Edition, 2007.
3. Mobile Communications – Design fundamentals: William C. Y. Lee, John Willey, 2 Edition, 2010
4. Computer Networks: Andrew Tanenbaum, 4th Edition, PHI.

Reference Books

1. J. E. Flood, "Telecommunications Switching, Traffic and Networks", Pearson Education
2. John C. Bellamy, "Digital Telephony", Third Edition; Wiley Publications
3. Computer Communication Networks: Frouzan, 4th Edition, Tata Mc-Graw Hill.

VII Semester

Department of Electronics and Communication Engineering

Course Code : HUT498-1 | **Course : Technical Communication**

L: 3Hrs, T: 0Hr, P: 0Hrs. Per week | **(Open Elective - IV)**

Total Credits : 03

Course Objectives

The aim of the course is develop effective writing skills for creating documents for workplace, research, and higher studies.

Course Outcomes

After completing the course the students will be able to do the following:

1. Understand the process and types of communication as well as the role of audience recognition in writing.
2. Apply the skills to create effective workplace correspondences
3. Apply basic grammar rules for effective writing
4. Evaluate and apply skills to generate professional reports
5. Develop skills to enhance visual appeal of documents.
6. Write effective documents for research and higher studies.

Unit - I

Technical communication : Definition, Barriers of Communication, Objectives of technical communication, Writing Process at work, Audience recognition and involvement.

Unit - II

Workplace correspondence : Letters: Job application, Job Description and Resume, Sales, enquiry, complaint, order, follow-up letters, email etiquettes,Notice, Agenda, Minutes of the Meetings, Instant and text messages at work

Unit - III

Grammar and Editing : Editing for grammar: Sentence fragments, comma splices, subject-verb agreement pronoun- antecedent agreement; Editing for punctuations; Editing for Mechanics

Unit IV:

Report writing : Criteria for report writing, types of reports: Trip, Progress, Feasibility / Recommendation, Annual, project/research

Unit - V

Visual appeal and document design : Document design: Importance, methods;Visual aid: Importance, types; User manuals, Brochures, Fliers

Unit - VI

Orientation in Research : Writing proposals, writing articles for journals and conferences, thesis writing, case study evaluation, Statement of Purpose for higher studies.

Text Books

1. Gerson and Gerson, "Technical Communication: Process and Product", 2018, Pearson
2. Meenakshi Raman and Sangeeta Sharma, "Technical Communication: Principles and Practice", 2015, Oxford University Press
3. Diana Hacker, Rules for Writers: A concise handbook, 2nd edition, 1988, St. Martin s Press, New York.
4. Kate L. Turabian, Wayne C. Booth, and Gregory G. Colomb, A manual for writers,

University of Chicargo Press, 9th edition, 2018

Reference Books/Material

1. IEEE Editorial Style Manual for Authors, 2019, IEEE Periodicals, Transactions/Journals Department, USA, Vol. 07.10.19.
2. S. Kumar and Pushplata, "Communication Skills", 2016, Oxford University Press
3. C. Muralikrishna and Sunita Mishra, "Communication Skills for Engineers", 2016, Pearson
4. Andrea Rutherfoord, "Basic Communication Skills for Technology", 2012, Pearson
5. Barun K Mitra, "Effective Technical Communication: A Guide for Scientists and Engineers", 2006, Oxford

IV Semester (Honors Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTH41 **Course : Communication System Analysis**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The Objective of this course is to make students aware of:

1. Advanced concepts in communication systems.
2. Various advanced modulation techniques.
3. Advanced concepts like synchronization, channel estimation

Course Outcomes

After completion of this course, the students will be able to:

1. Understand the advanced concepts in communication systems.
2. Understand advanced modulation techniques.
3. Know advanced concepts like synchronization, channel estimation
4. Analyze the behavior of ATM traffic in presence of congestion

Unit - I

Spread Spectrum Communications : Spreading sequences- Properties of Spreading Sequences, Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes Direct sequence spread spectrum – DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff

Unit - II

Orthogonal Frequency Division Multiplexing : Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and Spectral Efficiency, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation

Unit - III

MIMO Systems : Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM

Unit - IV

SONET/SDH : Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks, Virtual Tributaries.

Unit - V

ATM : Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols.

Unit - VI

ATM Traffic and congestion Control : Requirements for ATM Traffic and Congestion Control, Cell Delay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control

Text Books

1. Gary J. Mullett, "Introduction to Wireless Telecommunications Systems and Networks", CENGAGE
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2009
3. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM" Prentice Hall, 4th edition

Reference Books

1) Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
2. Behrouz A Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill.

V Semester (Honors Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTH51 **Course : Radio Frequency Circuit Design**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The Objective of this course is to make students aware of:

1. Modern RF electronics components and devices.
2. Issues encountered in high-frequency circuits, such as impedance matching, realization of passive components.
3. Architecture, specifications of RF transceiver and performance/testing issues like gain, isolation, Noise Figure.
4. Different topologies, major design issues and approaches of receiver blocks like noise amplifiers, mixers, power amplifiers and oscillators.

Course Outcomes

After completion of this course, the students will be able to understand:

1. Circuit design, Dimensions and units in RF frequency spectrum.
2. Design and dimensions of Microstrip Transmission Lines and its analysis
3. Filter Implementation in radio frequency domain.
4. Active RF Component and analog communication circuits

Prerequisites : Introduction to Electromagnetic Theory (PHT251), Electromagnetic Waves (ECT351)

Unit - I

Importance of radio frequency design, frequency spectrum, RF behavior of passive components: High frequency resistors, capacitors & inductors, Chip components and Circuit board considerations: Chip resistors, chip capacitors, surface mounted inductors, Examples of transmission Lines – 2 wire lines, Coaxial lines and Microstrip lines

Unit - II

The Smith Chart : Reflection coefficient in Phasor form, Normalized Impedance equation, Parametric reflection coefficient equation, graphical representation, Impedance transformation for general load, Standing wave ratio, Special transformation conditions, Admittance Transformations: Parametric admittance equation, Parallel and series Connections: Parallel connections of R and L connections, Parallel connections of R and C connections, Series connections of R and L connections, Series connections of R and C connections, Example of a T Network.

Unit - III

RF Filter Design : Filter types and parameters, Low pass filter, High pass filter, Bandpass and bandstop filter, Insertion Loss, Special Filter Realizations: Butterworth type filter, Chebyshev type filters, Denormalization of standard low pass design, Filter Implementation: Unit Elements, Kuroda's Identities and Examples of Microstrip Filter Design.

Unit - IV

Active RF Components and Biasing Networks : SiGe MOSFET, GaAs pHEMT, HBT and MESFET, PIN diode. Device parameters and their impact on circuit performance.

Matching Network, Microstrip lines Matching Network: From discrete component to Microstrip line, Stub Matching Networks

Unit - V

RF transistor amplifier : Amplifier Characteristics, Power relations, Stability considerations, Gain, Noise figure, Broadband, High power multistage amplifiers.

Unit - VI

Analog communication circuits : Mixers, phase-locked loops, oscillators, Transreceiver Architecture and performance specification, Recent Trends/Developments.

Text Books

1. RF Circuit Design: Reinhold Ludwig, Pavel Bretchko, Pearson Education Asia.
2. The Design of CMOS Radio Frequency Integrated Circuits: Thomas H. Lee- Cambridge University Pres

Reference Books

1) RF Microelectronics: Behzad Razavi - Mc Graw Hill.
2) Design of Analog CMOS integrated circuits: Behzad Razavi- McGraw Hill.

VI Semester (Honors Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTH61 **Course : Multimedia Networks**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. The operation of various switched networks and emerging technologies in multimedia communication networks.
2. Various media coding algorithms, transport and signaling protocols and their applications.

Course outcomes

After completion of this course, the students will be able to understand:

1. Functioning of circuit switched and packet switched networks
2. Reasons for emergence of converged communication networks
3. Various media coding algorithms and their applications
4. Emerging trends in multimedia networks.

Prerequisites : Analog and Digital Communication (ECT256), Wireless Communication (ECT355-3)

Unit - I

Review of circuit switched digital telephony, signaling and transmission, ISDN, SS7. Evolution of packet switched networks, Internet and LANs. The TCP/IP protocol stack.

Unit - II

Introduction to XoIP, network convergence, Needs of individual users, enterprises and network operators. How XoIP is expected to meet all these concerns.Unit III

Source coding (speech, audio and video coding) PCM, ADPCM, LP coding, CELP, RPE-LTP, adaptive sub-band coding, MPEG standards for audio and video coding.

Unit - IV

Signaling protocols : Review of H.323, MEGACO protocols, Session Initiation Protocol (SIP), detailed study of SIP, implementation of SIP through Java.

Unit - V

Media Transport : Need of special media transport protocols, RTP, RTCP, RTSP, QoS issues, routing, security etc.

Unit - VI

Modern network technologies : Mobile communication 3G, 4G, IMS, wireless LANs, wired networks. New services like IP-TV, multimedia conference calls, presence management, device and access independent services. VXML based applications

Text Books

1) O. Hersent, D. Gurle and JP Petit- "IP Telephony", Pearson Education Asia.

2) J. D. Gibson (Editor) "Multimedia Communications" – Harcourt India.

Reference Books

1) Bill Douskalis "IP Telephony", Prentice Hall.

2) R. Wittman, M. Zitterbart - Morgan Kaufman, "Multicast Communication".

VII Semester (Honors Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTH71 **Course : Crytptography and Information Security**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. Basic concepts of Cryptography and Symmetric ciphers.
2. Security at different OSI layers.
3. Survey role of software in Information Security and defense mechanism against the attacks.
4. Access enforcement of security policies based upon leading standards of Information Security.

Course Outcomes

After completion of this course, the students will be able to understand:

1. Fundamental concepts of Symmetric and Asymmetric Key Cryptography.
2. Various standard security protocols.
3. Different types of attacks and defenses against them.
4. How to write and enforce security policies based upon leading standards of Information Security.

Prerequisites : Computer Network (ECT357)

Unit - I

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Hashing and Digital Signatures, Symmetric ciphers and systems: Block and Stream, DES, AES.

Unit - II

Security at different OSI layers : Physical Layer: Separated Networks, Data Diode; Application layer: PGP or S/MIME; Network layer: IPSec; Transport layer: SSL & TLS

Unit - III

Introduction to Software and System Security: Buffer overflow and malicious software, Intrusion detection system, Firewall, DMZ. Common security problems including memory corruption,integer overflows, various injection attacks (command injection, SQL injection, XSS), Techniques to prevent and detect problems concerning software security.

Unit - IV

Organizational Security : Information Technology and Security Management, Standards: ISO27001/ ISO27002/ISO27005, Risk Management

Unit - V

Economics of Information Security : Rationality in behavior, Incentives and Externalities, Tragedy of commons, Market of lemons, Human factor in Information Security: Social Engineering/Phishing Campaigns

Unit - VI

Future Verticals of Information Security

Operational Security : Introduction to Critical Infrastructure Security, ICS/SCADA, IT VS OT. Automotive Security: Overview of In-Vehicle Architecture, Threat Landscape, Security Mechanisms.

Mobile Security : Radio Access Network Security, Introduction to 2G/3G/4G security.

Wi-Fi Security : Open Access vs Private Network, IEEE802.11i WLAN, WEP/WPA Security.

***Recent Trends :** Introduction to -Ethical Hacking/ Blockchain /Machine Learning in Cyber security

Text Books

1) Cryptography & Network Security: Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition MGH.

2) Computer and Information Security Handbook: John R Vacca, 3rd Edition MK.

Reference Books

1. Cryptography and Network Security: William Stallings, Fifth Edition Pearson.

2. Industrial Cyber security: Efficiently secure Critical Infrastructure security

VIII Semester (Honors Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTH81 **Course : Evaluation of Air Interface towards 5G**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. Understand about the 5G radio access methodologies and spectrum
2. Comprehend about 5G architecture
3. Know millimeter wave technology
4. Gain knowledge about the features of 5G Technology

Course Outcomes

After completion of this course students will be able to understand:

1. Describe the evolution of 5G, system concepts and spectrum challenges
2. Illustrate the architecture, Beamforming and hardware technologies for mmW communications
3. Describe and explain the requirements and fundamental techniques for MTC and D2D Communication
4. Illustrate and explain the fundamentals, resource allocation and transceiver algorithms for Massive MIMO

Prerequisite : Wireless Communication (ECT355 – 3)

Unit - I

Overview of 5G Communication Technology

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios

UNIT - II

5G Architecture and Millimeter Wave Communication

5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment.

UNIT - III

Millimeter Wave Communication

Millimeter Wave Communication : Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

UNIT - IV

Machine Type and D2D Communication

MTC : Use cases and Categorization – MTC Requirements – Fundamental Techniques for MTC – Massive MTC –from 4G to 5G – Radio Resource Management for Mobile Broadband D2D – Multi-operator D2D Communication

UNIT - V

5G Radio Access Technologies

Access Design Principles for Multi-user Communications – Multi-carrier with Filtering – Nonorthogonal Schemes for Efficient Multiple Access – Radio Access for Dense Deployments – Radio Access for V2X Communication – Radio Access for Massive Machine-type Communication.

UNIT - VI

Massive Multiple-input Multiple – Output Systems

MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models

Text Books

1. Fundamentals of 5G Mobile Networks, Publisher(s): Wiley, ISBN: 9781118867525
2. Asif Oseiran, Jose F. Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.

Reference Books

1. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015
2. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018

IV Semester (Minor Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTM41 **Course : Communication Engineering**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The Objective of this course is to make students aware of:

1. Various analog modulation schemes
2. Basics of Noise
3. Various digital modulation schemes
4. Recent communication technologies

Course Outcomes

After completion of this course, the students will be able to:

1. Analyze various analog modulation schemes such as AM, FM etc.
2. Understand basics of Noise includes effect of noise on communication
3. Analyze various digital modulation schemes
4. Analyze recent communication technologies such as CDMA, GSM etc.

Unit - I

Basic Communication System, Classification of electronic communication system, Need of modulation, Principles of Amplitude Modulation Systems- DSB, SSB, Angle Modulation, Representation of FM and PM signals.

Unit - II

Introduction to Noise, Types of Noise, Noise Calculation, Noise factor, Noise Temperature, Pre-Emphasis and De-Emphasis

Unit - III

Pulse modulation, Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation and Adaptive Delta Modulation.

Unit - IV

Digital Modulation schemes- Amplitude shift Keying, Phase Shift Keying, and Frequency Shift Keying.

Unit - V

Spread – Spectrum Communication: - Study of PN sequences, direct sequence methods, Frequency hop methods, slow and fast frequency hop.

Unit - VI

Code Division Multiple Access (CDMA), GSM, LTE, Recent Trends/Developments

Text Books

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, "Modern Digital and Analog Communication Systems", Third Edition, Oxford University press.

Reference Books

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
2. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
5. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.
6. George Kenndey, 4th Edition , " Electronics Communication systems "

V Semester (Minor Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTM51 **Course : Sensor of Smart City**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The Objective of this course is to make students aware of:

1. Basic understanding of Smart city concept.
2. Fundamentals of sensors & sensing technologies used in smart cities.
3. Identification and selection of various types of sensors used in Smart City.

Course Outcomes

After completion of this course, the students will be able to:

1. Employ the knowledge of mathematics, science, and engineering to understand fundamentals of sensor systems.
2. Understand the applications of sensors in smart cities.
3. Learn IEEE Standards for advance Sensors
4. Comprehend actuating devices for sensor systems.

UNIT - I

Smart City : Concept, Definition, Criteria for smart cities, Smartness (Eg. Environment, Mobility, Economy, Utilities, Transportation, road Infrastructure, Health Care etc.)

Unit - II

Sensor Characteristics : Transfer function, accuracy, calibration, hysteresis, nonlinearity, saturation, repeatability, dead band, resolution, output impedance, excitation, dynamic characteristics, environmental factors, reliability and application characteristics.

Unit - III

Review of transducers for various parameters (like temperature, pressure, flow, level, humidity, acceleration, vibration etc.)

Unit - IV

Sensor Materials and overview of sensor technologies : Silicon as Sensing Material, Plastics, Metals, Ceramics, Glasses, Optical Glasses, Nano-materials, Overview of Surface Processing technologies.

Unit - V

IEEE Standards for advance Sensors : Fundamentals, IEEE 1451 standard for smart sensors, Sensor Signals and Systems, Sensor specifications, Sensor Characteristics, Physical principles of sensing.

Unit - VI

Applications : Smart street lighting, Smart Parking, Environmental pollution monitoring, Vehicular tracking, Smart Traffic Control, Waste Management, Smart Grid, Smart Cars, Smart Homes, Smart Domestic Appliances, Smart Toys etc.

Text Books

1. D. V. S. Murty, "Transducers and Instrumentation", Second edition, PHI publication, Second edition, 2010.
2. Randy Frank, "Understanding Smart Sensors", Artech House Inc., 2nd Edition.
3. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Springer; 4th editon.
4. Carlo Ratti and Matthew Claudel, -The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life (The Future Series), Yale University Press.

Reference Books

1. Mohammad Hammoudeh & Mounir Arioua, "Sensors and Actuators in Smart Cities" (Open Access book) MDPI, Basel, Switzerland.
2. Gerard Meijer, "Smart sensor systems", Wiley, 2008
3. W Gopel, J. Hesse, J. N. Zemel, "Sensors A Comprehensive Survey" Vol. 9, Wiley- VCH, 1995

VI Semester (Minor Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTM61 **Course : IoT for Industrial Application**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. IoT scope and its applications
2. Hands on experience with Raspberry pi SBC
3. Python Programming and Linux environment

Course Outcomes

After completion of this course students will be able to:

1. Understand the scope of IoT.
2. Explore the linux environment for SBC (Single Board Computer)
3. Demonstrate IoT based applications on Raspberry Pi
4. Use Python-based IDE and trace and debug Python code on the Raspberry Pi for IoT applications.

Unit - I

Introduction to Internet of Things : Concept and its need, architecture, scope and applications, Overview of Networking and protocols applicable to IoT.

Unit - II

Exploring the platforms/ hardware for IoT : Getting Started with Raspberry Pi, Basic and functionality of the Raspberry Pi board and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like Arduino, Over-clocking, Component overview.

Unit - III

Introduction to Linux : Implications of an operating system on the behaviour of the Raspberry Pi, Overview of Linux and its terminal command, apt-get-update, apt-get-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Unit - IV

Programming the Raspberry Pi: Python : Introduction to Python programming language : Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries.

Unit - V

Sensors and Actuators (Light Sensors, Ultrasonic, Temperature and humidity,etc) for IoT, Wired and Wireless communication, Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPi. GPIO library, Communication Using Raspberry Pi for IoT applications.

Unit - VI

Applications of IoT : Case studies based on Commercial products, Applications / Product Development of IoT based application

Text Books

1) Designing the Internet of Things, Adrian McEween and Hakim Cassimally, 1st Edition John Wiley and Sons, Ltd.

Reference Books

1. Learning of Internet of Things, Peter Waher, 1st Edition Packet Publishing.
2. Raspberry Pi 3 : An Introduction to Using with Python Scratch, Javascript and more, Gary Mitnick, Create Space Independent Publishing Platform, 2017.
3. Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
4. Raspberry Pi User Guide, Eben Upton and Gareth Half acere, John Wiley & Sons, 2016

VII Semester (Minor Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTM71 **Course : Mobile Communication**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to:

1. Make students understand Mobile communication Technology.
2. Let students know higher generation mobile technology.

Course Outcomes

After completion of this course students will be able to understand:

1. The Concepts of Cellular Communication.
2. Modulation Techniques and Coding in Mobile Communication.
3. Various Multiple Access Techniques used in Mobile communication
4. GSM and higher generation mobile technology

Unit - I

The Cellular Concepts : Architecture of mobile communication systems, call processing, cellular concepts, Frequency reuse, channel assignment, Hand of strategies interference & system capacity, improving grade of service & capacity in cellular systems.

Unit - II

Modulation Techniques in Mobile Communication BPSK, QPSK and variants, QAM, MSK and GMSK,

Unit - III

Coding in Mobile Communications : Block Codes, Low Density Parity Check Codes

Unit - IV

Multiple access techniques : Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Space Division Multiple access (SDMA)

Unit - V

GSM- global system for mobile : Services, features, architecture, GSM radio subsystem, GSM channel types, frame structure, call setup in GSM

Unit - VI

Introduction to CDMA and higher generation mobile communication technologies

Text Books

1) WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.

2) Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.

Reference Books

1) Wireless Communications: Principles and Practice, Pearson, 5e

2) AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.

3) VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

VIII Semester (Minor Scheme)

Department of Electronics and Communication Engineering

Course Code : ECTM81 **Course : Future Generation Networks**

L: 4Hrs, T: 0Hr, P: 0Hrs. Per week **Total Credits : 04**

Course Objectives

The objective of this course is to make students aware of:

1. Fundamentals of wireless communications
2. Existing and emerging wireless communications networks
3. Evolution of wireless networks from the first generation to LTE and LTE advanced, 5G

Course Outcomes

After completion of this course students will be able to:

1. Understand diversity techniques to improve performance
2. Describe current and future cellular mobile communication systems
3. Learn 3G and 4G Major Technical Standards
4. Describe the characteristics of the OFDM, 5G system concepts

UNIT - I

Overview of wireless communications and systems, Review of digital communications, Cellular systems from 1G to 3G

UNIT - II

Wide-area wireless networks (WANs),3G and 4G Wireless Standards- GSM, GPRS, WCDMA

UNIT - III

Long Term Evolution Technologies (LTE), OFDM, MIMO channels, LTE Advanced

UNIT - IV

OFDM -Introduction, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues

UNIT - V

MIMO -Introduction, MIMO Channel Capacity, Other Wireless systems IEEE 802.11, WLAN (Wi-Fi) WiMAX

UNIT - VI

5G – Introduction, Architecture, Basics about RAN Architecture, Physical Architecture and 5G Deployment

Text Books

1. Wireless Communication, Rappaport, 2nd Edition Pearson
2. Mobile Wireless Communications, Mischa Schwartz. Paperback(2 0 1 3) ISBN: 978110741271
3. Cambridge University Press. References: The evolution to 4G cellular systems: LTE- Advanced. Ian F. Akyildiz, David M. Gutierrez Estevez, Elias Chavarria Reyes.

Reference Books

1. Iti Saha Misra, "Wireless Communication and Networks – 3G and Beyond", Mc Graw Hill Education, Second Edition, 2013.
2. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.

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