DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM DEVELOPMENT DOCUMENT FOR B. TECH (ECE) 2017

Vision of University

To be a globally renowned university.

Mission of University

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

Vision of Department

- To evolve into a globally recognized department in the frontier areas of Electronics & Communication Engineering (ECE).

Vision of Department

M1- To produce graduates having professional excellence.
M2- To carry out quality research having social & industrial relevance.
M3- To provide technical support to budding entrepreneurs and existing Industries**.**

Academic Goals:

G1. To offer academic flexibility by means of Choice based credit systems and the like.
G2. To identify and introduce new specializations and offer programs in emerging areas therein
G3. To incorporate into the curriculum the Application orientation and use high standards of competence for academic delivery
G4. To design and implement educational system adhering to outcome based international models.
G5. To introduce and implement innovation in teaching and learning process to strengthen academic delivery
G6. To offer academic programs at UG, PG, doctoral, Post-Doctoral which are industry focused, and incorporates Trans-discipline, inter-discipline aspects of the education system
G7. To deliver higher education that includes technologies and meeting the global requirements

(DEEMED TO BE UNIVERSITY)

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

- **PEO1:** Practice engineering in a broad range of industrial, societal and real world applications.
- **PEO2:** Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.
- **PEO3:** Conduct themselves in a responsible, professional, and ethical manner.
- **PEO4:** Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.

PROGRAM OUTCOMES

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES

PSO1	An ability **to Understand the theoretical and mathematical concepts to analyze real time problems.**
PSO2	An Ability **to Design and Analyze systems based on the theoretical and Practical Knowledge**

Mapping of GOALS with MISSION:

Academic Goals	Mission Statements		
	M1	M2	M3
G1	✓		
G2		✓	
G3		✓	✓
G4	✓		
G5			✓
G6	✓		
G7	✓	✓	✓

Mapping of mission statements with program goals

	Academic Goals						
	G1	G2	G3	G4	G5	G6	G7
PEO1	✓	✓		✓			
PEO2	✓				✓	✓	✓
PEO3			✓			✓	✓
PEO4		✓		✓	✓		

Mapping of PEOs with POs

	PEO1	PEO2	PEO3	PEO4
PO1	✓	✓		
PO2	✓	✓		
PO3	✓	✓		✓
PO4	✓	✓		✓
PO5	✓	✓		
PO6	✓	✓	✓	✓
PO7	✓			✓
PO8	✓		✓	
PO9	✓		✓	✓
PO10	✓		✓	✓
PO11	✓	✓		✓
PO12	✓			✓
PSO1	✓	✓		
PSO2	✓	✓		

B. Tech (ECE) program for the academic year 2017-18 has been framed to be in relevance to APIIC, Human Resource Development Policy, Govt. of India, National Skill Development Corporation, Govt. of India, Confederation of Indian Industries, ABET, NBA norms, O*NET NASSCOM, AP state IT policy and AICTE statutory norms.

As per the recommendations of APIIC number of courses are introduced in the areas of wireless communication, energy-related and verbal and written communication.

As per the recommendations of NSDC Electronics IT hardware numbers of courses are introduced in management courses, basic electronics related, wireless communication, artificial intelligence, bio-medical electronics and automotive electronics related courses are included in the curriculum of ECE.

As per the recommendations of NSDC –IT and ITES number of courses are introduced in the areas of application development, Project management, Testing and quality assurance, Data processing, Web development, UI development, Cloud computing, IoT, MEMS, Signal Processing, and Embedded systems.

As per the recommendations of O*net number of courses are introduced in the areas of VLSI, Wirelss Communications, IOT and Smart cities, Robotics and automation, Data communication, Bio-medical instrumentation, reasoning, and analysis, Team building & communication, Object oriented programming, Matlab programming, Mentor Graphics, Xilinx, software tools, design thinking, English language, Active listening, Critical thinking, Drafting and documentation skills.

As per the recommendations of AICTE number of courses are introduced in the areas of Mathematics, Engineering sciences, Humanities and management courses, English and communication development courses, Professional ethics, Heritage and culture and human values.

As per the recommendations of NASSCOM and AP state software policy number of courses are introduced in the areas of Internet of things, Artificial Intelligence, machine learning, data networking, programming for VLSI, and automated electronics.

Apart from these inputs, all stake holders like recruiting companies, exit feedback from our final year students and parents, alumni feedback and academic peer feedback is also considered while making the final program.

Thus, framed curriculum has been developed through framing of Program Educational Objectives (PEO's) which are mapped to the university Vision and Mission, which are there

by disseminated into Program Outcomes (PO's) which thereby have been developed into relevant Course Outcomes (CO's).

Thrust areas of Electronics and Communications Engineering			
LOCAL	**REGIONAL**	**NATIONAL**	**GLOBAL**
APIIC	***NASSCOM***	***NSDC Electronics – IT hardware***	***O*net network Architect***
Wireless communications	IOT	management courses	VLSI
Renewable energies	Machine learning and artificial intelligence	Basic electronics	Wireless Communication
Importance of communication	data networking	Electronics and computer related courses	Bio-medical Instrumentation
	programming for VLSI	Embedded Systems	Data Communication
	Automated electronics		Robotics and automation
AP state software policy		***NSDC –IT and ITES***	***O*net programmer***
IoT		Application development	Python programming
Big data analytics		Project management	Object oriented programming
Machine learning		Testing and quality assurance	Matlab programming
Cloud networking		Data Communications	English language
		IoT	Active listening
		UI development	Critical thinking
		Cloud computing	Drafting skills
		Automation	documentation skills
		Automated Electronics	
		Electronic Instrumentation	
		AICTE	

		Mathematics	
		Engineering sciences	
		Humanities and management courses	
		English and communication development courses	
		Professional ethics Heritage and culture	
https://www.apiic.in/	**https://nasscom.in/knowledge-centre**	**https://nsdcindia.org/**	**https://www.onetonline.org/link/summary/15-1241.00?redir=15-1143.00**

Mapping of needs with Mission:

Local, Regional, National and Global Needs		Mission Statements		
		M1	M2	M3
Local Needs	L9-Electronics HuB	✓		✓
	L10-Aviation &Defense		✓	✓
	L14-Electronics & Information Technology	✓		
	L16-Sensor Technology	✓		✓
	L17-Internet of Things	✓		✓
	L19-Remote Sensing	✓		✓
	L20-Medical Electronics		✓	
	L21-Nano Technology		✓	
Regional Needs	R4-Electronics	✓		✓
	R5-Aviation &Defense	✓	✓	
	R8-Energy		✓	
	R11-IT hardware including bio-medical devices, electronics, and cellular communication	✓	✓	
	R18-Renewable energy and solar parks	✓	✓	
	N10-Electronics Sector	✓		✓
	N11-Nanoscience		✓	
	N13-Security	✓		✓
National Needs	N14-Media and Entertainment	✓		✓
	N15-Electronic and IT Hardware	✓	✓	
	N19-Telecommunication	✓		✓
	N22-VLSI and Semiconductor design	✓	✓	✓
	N23- Consumer Electronics	✓	✓	
	N24- Internet of Things	✓		✓
	N25- Cloud Computing	✓		✓
	N26-Industrial Electronics	✓	✓	
	N27-Automotive Electronics	✓	✓	
	N28-Embedded and Real time systems	✓	✓	✓
	N29-Renewable Energy Sources	✓	✓	✓
Global Needs	G3- New energy supplies and technologies	✓	✓	
	G4- Internet of Things	✓		✓

	G6- Robotics, autonomous transport	✓		
	G7- Artificial intelligence	✓		
	G10- ICT in education	✓		
	G11- Skills development for work	✓		
	G17- Energy	✓	✓	
	G18- Information & Communication technology	✓		
	G20- Nanotechnology		✓	
	G21- Critical thinking			✓
	G22- Machine learning	✓	✓	
	G35- Sensor Networks	✓		
	G36- Embedded System Technology	✓	✓	✓
	G37- Real Time Systems Design	✓	✓	✓
	G38- Remote Sensing	✓		

Courses Introduced in 2020-21 Curriculum as per Local, regional, National and Global Needs:

Local, Regional, National and Global Needs		Courses introduced in 2020-21 curriculum as per identified needs
Local Needs	L9-Electronics HuB	Electronics System Design Workshop
	L10-Aviation &Defense	Automated Vehicles & Avionics
	L14-Electronics & Information Technology	Analog Electronic Circuit Design, IT Workshop
	L16-Sensor Technology	Wireless sensor Networks & IOT Applications
	L17-Internet of Things	Processors & Controllers, IoT Workshop, IoT Specialization
	L19-Remote Sensing	Wireless Sensors Networks & IoT
	L20-Medical Electronics	Biomedical Electronics & IOT for Healthcare
	L21-Nano Technology	Semiconductor Memories & MEMS
Regional Needs	R4-Electronics	Electronics System Design Workshop
	R5-Aviation &Defense	Automated Vehicles & Avionics
	R8-Energy	Electronic Systems for Renewable Energy & Smart Grid
	R11-IT hardware including bio-medical devices, electronics, and cellular communication	Biomedical Electronics & IOT for Healthcare, Electronic Instruments & Biomedical Applications
	R18-Renewable energy and solar parks	Electronic Systems for Renewable Energy & Smart Grid
	N10-Electronics Sector	Analog Electronic Circuit Design
	N11-Nanoscience	Semiconductor Memories & MEMS
	N13-Security	Cyber Security & Blockchain Technology
National Needs	N14-Media and Entertainment	Wireless Communications
	N15-Electronic and IT Hardware	Analog Electronic Circuit Design, IT Workshop, Electronics System Design Workshop
	N19-Telecommunication	Wireless Communications
	N22-VLSI and Semiconductor design	VLSI Design and VLSI Specialization
	N23- Consumer Electronics	Electronics System Design Workshop
	N24- Internet of Things	Processors & Controllers
	N25- Cloud Computing	Cloud-Computing & Network Security
	N26-Industrial Electronics	Calibrations and Designing Advanced Instruments
	N27-Automotive Electronics	Autonomous Vehicles & Automotive Electronics
	N28-Embedded and Real time systems	Embedded Controllers & Embedded Systems Design
	N29-Renewable Energy Sources	Electronic Systems for Renewable Energy & Smart Grid
Global Needs	G3- New energy supplies and technologies	Electronic Systems for Renewable Energy & Smart Grid
	G4- Internet of Things	Embedded Controllers, IoT Workshop, IoT Specialization
	G6- Robotics, autonomous transport	Autonomous Vehicles & Automotive Electronics
	G7- Artificial intelligence	AI & ANN Tools and Applications
	G18- Information & Communication technology	Wireless communication and Data Communications specialization
	G20- Nanotechnology	Semiconductor Memories & MEMS
	G21- Critical thinking	Aptitude Builder I & II
	G22- Machine learning	AI & ANN Tools and Applications
	G35- Sensor Networks	Wireless Sensors Networks & IoT

	G36- Embedded System Technology	Embedded Controllers & Embedded Systems Design
	G37- Real Time Systems Design	Embedded Controllers & Embedded Systems Design
	G38- Remote Sensing	Wireless Sensors Networks & IoT

Mapping of mission statements with program educational objectives

	Description of PEOs	M1	M2	M3
PEO1	Practice engineering in a broad range of industrial, societal and real world applications.	✓	✓	✓
PEO2	Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.	✓	✓	✓
PEO3	Conduct themselves in a responsible, professional, and ethical manner.	✓		✓
PEO4	Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.	✓	✓	✓

MAPPING OF POs/PSOs with PEOs:

S No.	Key Components of POs and PSOs	Description of PEO			
		Practice Engineering in a broad range of industrial, societal and real world applications	Pursue advanced education, research and development, andother creative andinnovative effortsin science, engineering, and technology, as well as other professional careers.	Conduct themselves ina responsible, professional, and ethical manner.	Participate asleaders in their fields of expertise andin activities that support service and economic development throughout the world.
		PEO 1	**PEO 2**	**PEO 3**	**PEO 4**
PO1	**Engineering knowledge**	✓	✓		
PO2	**Problem analysis**	✓	✓		
PO3	**Design/development of solutions**	✓	✓		✓
PO4	**Conduct investigations of complex problems**	✓	✓		✓
PO5	**Modern tool usage**	✓	✓		
PO6	**The engineer and society**	✓	✓	✓	✓
PO7	**Environment and sustainability**	✓			✓
PO8	**Ethics**	✓		✓	
PO9	**Individual and teamwork**	✓		✓	✓
PO10	**Communication**	✓		✓	✓
PO11	**Project management and finance**	✓	✓		✓
PO12	**Life-long learning**	✓			✓
PSO1	**Engineering knowledge**	✓	✓		
PSO2	**Problem analysis**	✓	✓		

GLOBAL, LOCAL AND REGIONAL NEEDS

Thrust/Focussed areas as per APIIC, Telangana Industrial policy, CII, NSDC, Planning commision, UGC, US O*NET, World Economic Forum, UNESCO.

Local Needs identified as per policy document of APIIC from 2017 to 2022		Regional Needs as per policy documents of APIIC & Telangana Industrial policy upto 2022		National Needs as per policy documents of CII, NSDC, Planning commision, UGC from 2017 to 2022		Global Needs as per policy documents of US O*NET, World Economic Forum, UNESCO from 2017 to 2022	
L1	Pharmaceutical Hub	R1	Agro & Food Processing	N1	Industry Deep Dive: Banking	G1	Mobile internet, cloud technology
L2	Fabrication Hub-Rubber and Fabricated Metal	R2	Life sciences (including pharma, biotechnology and medical equipment)	N2	Industry Deep Dive: Telecom	G2	Processing power, Big Data
L3	Value added Economic Hub- FTZ/SEZ Zone-Textile, Auto, Aerospace &IT/ITeS	R3	Textile & Apparel	N3	Industry Deep Dive: Manufacturing	G3	New energy supplies and technologies
L4	Aquaculture Hub - Logistics Park	R4	Electronics	N4	Industry Deep Dive: Media, Publishing, and Entertainment	G4	Internet of Things
L5	Manufacturing Hub - Agro, Textile, Metal and Mineral	R5	Aviation &Defense	N5	Bio-Technology	G5	PCT patents, applications
L6	Agricultural Trading Hub – Agro Processing and Textile	R6	Auto & Auto Components	N6	Material Science	G6	Robotics, autonomous transport
L7	Heavy Industries Hub - Textile and Mineral Products	R7	Petroleum, Chemicals, (including Fertilizers) and Petrochemicals	N7	Industry Deep Dive: Healthcare	G7	Artificial intelligence
L8	Tourism Hub-Temples, Schools and Heritage	R8	Energy	N8	Media &Social Development	G8	Adv. manufacturing, 3D printing
L9	Electronics HuB	R9	Mineral based industry (e.g.Cement)	N9	clean tech	G9	Adv. materials, biotechnology
L10	Aviation &Defense	R10	Leather	N10	Electronics Sector	G10	ICT in education
L11	Automobile and Auto Components	R11	IT hardware including bio-medical devices, electronics, and cellular communication	N11	Nanoscience	G11	Skills development for work
L12	Robust IT platform	R12	Food processing	N12	Cognitive Science	G12	Global citizenship education
L13	IT based Platform for real time monitoring	R13	Automobiles, tractors and farm equipment	N13	Security	G13	Foresight and research
L14	Electronics & Information Technology	R14	Plastics and polymers	N14	Media and Entertainment	G14	lifelong learning for all
L15	Energy	R15	Fast-moving consumer goods and domestic appliances	N15	Electronic and IT Hardware	G15	creative and responsible global citizens
L16	Sensor Technology	R16	Engineering and capital goods	N16	Pharma and Life Sciences	G16	health through education

L17	Internet of Things	R17	Waste management and green technologies	N17	IT-ITeS Sector	G17	Energy
L18	Software Technology	R18	Renewable energy and solar parks	N18	Tourism, Hospitality and Travel	G18	Information & Communication technology
L19	Remote Sensing			N19	Telecommunication	G19	Active Learning
L20	Medical Electronics			N20	Automotive Skill Development	G20	Nanotechnology
L21	Nano Technology			N21	Security Sector	G21	Critical thinking
				N22	VLSI and Semiconductor design	G22	Machine learning
				N23	Consumer Electronics	G23	Programming
				N24	Internet of Things	G24	Higher education and training
				N25	Cloud Computing	G25	Quality control
				N26	Industrial Electronics	G26	Basic Skills
				N27	Automotive Electronics	G27	FDI and technology transfer
				N28	Embedded and Real time systems	G28	Improving learning process and skills
				N29	Renewable Energy Sources	G29	Building effective partnership for education
						G30	Technological Readiness
						G31	Innovation
						G32	University-industry collaboration in R&D
						G33	Remote Infrastructure management
						G34	Mobile Computing
						G35	Sensor Networks
						G36	Embedded System Technology
						G37	Real Time Systems Design
						G38	Remote Sensing
						G39	Reliable Sources

				PO												PSO	
SNO	COURSE CODE	Co	COURSE NAME	1	2	3	4	5	6	7	8	9	10	11	12	1	2
			HUMANITIES & SOCIAL SCIENCES														
1	17EN1201	1	Improve pronunciation skills and understand the method of identifying antonyms.									2					
		2	Apply writing strategies for office/ formal communication												2		
		3	Analyze types of reading techniques and improve reading speed.									2					
		4	Analyze different cultures and the importance of empathy in cross-cultural communication.									2			2		
2	17EN3102	1	Improve pronunciation skills and understand the method of identifying antonyms.							2					2		
		2	Apply writing strategies for office/ formal communication														
		3	Analyze types of reading techniques and improve reading speed.														
		4	Analyze different cultures and the importance of empathy in cross-cultural communication.														
3	17UC2204	1	Apply the concept of Critical Reading and Analytical Reading and comprehend the key ideas and gist of a passage. Understand the importance of the presentation skills, analyze the given topic, apply various strategies and the principles of grammar in written expression.					2	2								
		2	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.							2			2				
		3	Apply the concepts of Numbers to solve the problems related to divisibility rules, problems based on Unit's digit, Remainders, Successive Division, Prime Factorization, LCM & HCF problems. Apply the concepts of Averages &Alligations, students will be able to solve the problems related to Averages as well as problems based on Mixtures.	2				2									

		4	Apply the various concepts of cubes to find out how to cut a cube to get the maximum number of smaller identical pieces, how to minimize the number of cuts required to cut a cube into the given number of smaller identical pieces, how to count the number of smaller cubes which satisfy the given painting scheme. Apply the principles of binary logic to solve problems involving truth-tellers, liars and alternators. Analyze the given data to form an ordered arrangement from an unorganized raw data.	2				2									
4	17UC3105	1	Apply the strategies and techniques learnt in carrying out conversations in different contexts. Analyse the different parameters and formats of written technical communication and apply in everyday work and life.								2		2					
		2	Analyse the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.								2		2					
		3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest, students will be able to solve the problems based on Ratios, problems involving Percentages, problems related to cost price, selling price, profit, loss, marked price and discounts, problems involving interest.	2				2										
		4	Analyse the given series of numbers to predict the next number in the series. Analyse the given set of numbers or letters to find the analogy. Analyse the given data to find the code which is used to encode a given word and use the same code in the process of decoding. Apply the given set of conditions to select a team from a group of members.	2														
5	17UC0007	1	Familiarizing students with various aspects of Indian culture and how they contribute to the concept of Unity in Diversity						2									
		2	Understand the beginnings of Indian History and the developments during the Ancient period						2									
		3	Understand the developments in India during the Medieval Age along with how they contributed to Indian civilization						2									

		4	Understand the reasons for colonial rule over India and how independence was achieved from British rule						2									
6	17UC0008	1	To understand Constitutional development after Independence						1	1		1						
		2	To learn the fundamental features of the Indian Constitution						1	1		2						
		3	To get a brief idea of the powers and functions of Union and State Governments						1	2		3						
		4	To understand the basics of working of Indian Judiciary and the Election Commission						1	1		1						
7	17UC0009		Understand the importance of environmental education and the conservation of natural resources.	2		2												
			Understanding the importance of ecosystems and biodiversity.	2		2												
			Understanding the environmental pollution.	2		2												
			Understanding the solid waste management, disaster management and EIA process.	2		2												
8	17AC1008		Universal Human Values & Professional Ethics								1							
II			**BASIC SCIENCES**															
1	17BT1001	1	Understand the basis of Life, Living organisms and human body systems	2		2	2				2					2		
		2	Understand the importance of Diet and Nutrition	2		2	2				2					2		
		3	Acquire the knowledge of beneficial and harmful Microorganisms and Biosensors	2		2	2				2					2		
		4	Understand the importance of Biosensors	2		2	2				2					2		
2	17CY1001	1	Predict potential complications from combining various chemicals or metals in an engineering setting		2	4												
		2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena		2	3												
		3	Examine water quality and select appropriate purification technique for intended problem		2	3												
		4	Apply polymers, conducting polymers ,green chemistry and nano chemistry to engineering processes			3												

		5	An ability to analyze & generate experimental skills		2	4												
3	17MT1101	1	Model the physical laws and relations mathematically as a first order differential equations, solve by analytical and numerical methods also interpret the solution.	2														
		2	Model physical laws and relations mathematically as a second/higher order differential equations, solve by analytical method and interpret the solution.		2													
		3	Obtain the Fourier series expansions of periodic functions and use the series to solve ordinary differential equations.	2														
		4	Model physical problems mathematically as a system of linear equations and solve them by analytical and numerical methods. Also, determine the nature of Quadratic form using Eigen values.	2	2													
4	17MT1102	1	Identify the quantities of Real world problems by using the concepts of arithmetic.	2														
		2	Computing the areas of regular and irregular solids of real world problems.	2														
		3	Identifying the numbers by successive division also finding the solution of equations.	2														
		4	Estimating the roots of an equations and find the unknown values from the data by numerical methods											1				
5	17MT1203	1	Determine extreme values for functions of several variables	3														
		2	Determine area, volume moment of inertia through multiple integrals in Cartesian or polar co-ordinates.	3														
		3	Apply the concepts of vector calculus to calculate the gradient, directional derivative, arc length, areas of surfaces and volume of solids in practical problems	3														
		4	Obtain analytical and numerical solutions of Heat and wave equations	3														
		5	Verify the solution of problems through MATLAB	3														

6	17MT1204	1	Understand how to use Venn diagrams to find the conclusion of statements, solve puzzles using binary logic.	2														
		2	Understand to solve problems on clocks, calendars and problems on Non verbal reasoning.	2														
		3	Understand the available models for Venn diagrams with given data, solve problems relating to cubes and number and letter series.			2												
		4	Understand the techniques used to solve problems puzzles using analytical reasoning on coding and decoding and blood relations	2		2												
7	17PH1001	1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.	1														
		2	Understands magnetic properties of materials and identifies their role in classification soft & hard magnetic materials having specific engineering applications.	1														
		3	Understands thermal and mechanical properties of materials, heat treatment methods for changing the microstructure of materials and responses of materials subjected to load.	1														
		4	Understands the role of electronic energy band structures of solids in governing various electrical and optical properties of materials.	1														
		5	Apply the knowledge on structure and properties of materials while executing experiments and develop inter disciplinary projects.	2														
8	17MT2009	1	Apply the probability and joint and marginal probabilities to suitable real-world situations.	3														
		2	Apply probability distributions to suitable real- world situations and also analyze bivariate data using correlation and regression analysis.	3														
		3	Apply Markov chains and simulation techniques for suitable real world problems.	3														

		4	Apply queuing models for single server with finite and infinite capacity and multi server with infinite capacity to suitable real world problems.	3														
III			**ENGINEERING SCIENCES**															
1	17ME1001	**1**	Understand the concept of forces and apply the static equilibrium equations.		2													
		2	apply principles of co-planar and non co-planar system of forces		2													
		3	Apply the concept of centroid & centre of gravity to determine moment of inertia.		2													
		4	apply the kinetics and kinematics principles to rigid bodies under translation and rotation		2													
		5	Understand and apply the engineering systems with the help of mechanics concept to solve the engineering problems.		2													
2	17CS2004	1	The student will be able to understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language.	2	2													
		2	The student will be able to apply constructors, Overloading, parameter passing, in Java programming.	2	2													
		3	The student will be able to apply access control, Inheritance, Packages.	2	2													
		4	The student will be able to apply , Interfaces, Exception Handling	2	2													
		5	Students will be able to apply object oriented programming concepts to write programs.	2	2													
3	17CS1102	1	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms.	1	2													
		2	Analyse and compare stack ADT and queue ADT implementations using linked list and applications.	2			2											
		3	Analyse the linked implementation of Binary, Balanced Trees and different Hashing techniques.		1		2											

		4	Analyse different representations, traversals, applications of Graphs and Heap organization.	2	2													
4	17ME1003		Workshop Practice			2	2	2										
5	17CS1101	1	Illustrate how problems are solved using computers and programming.	1	2													
		2	Illustrate and use Control Flow Statements in C.	1	1													
		3	Interpret & Illustrate user defined C functions and different operations on list of data.	1	1													
		4	Implement Linear Data Structures and compare them.				2									2		
6	17ME1002	1	To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects, Orthographic projections of points, lines and planes													2		
		2	Draw projection of solids like cylinders, cones, prisms and pyramids including sections. Layout development of solids for practical situations. Generating the sectional views and Draw simple curves like ellipse, cycloids and developments of surfaces for various geometry		2											2		
		3	Build orthographic projections, create isometric sketches and identify standard features such as hole, slots, etc…		2											2		
		4	Create, annotate, edit and plot drawings using basic AutoCAD commands and features.		2											2		
		5	Demonstrate competency with multiple drawing and modification commands in Solid Works.		2											2		
7	17GN1003	1	Understand and apply the Basic fundamentals of a measurement system.	1														
		2	Understand various Mechanical measuring parameters, and apply different measuring techniques on various mechanical parameters using simulation and experimentation tools.	2														
		3	Understand various Electrical measuring parameters, and apply different measuring techniques on various Electrical parameters using simulation and experimentation tools.	1														

		4	Understand various Electronic measuring parameters, and apply different measuring techniques on various Electronic parameters using simulation and experimentation tools.	1														
		5	Apply the theoretical concepts to measure different parameters.	1		3												
8	17GN1204	1	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms	4														
		2	Analyze and compare stack ADT and queue ADT implementations using linked list and applications.		4													
		3	Analyze the linked implementation of Binary, Balanced Trees and different Hashing techniques.	4														
		4	Analyze different representations, traversals, applications of Graphs and Heap organization.		4													
		5	Develop and Evaluate common practical applications for linear and non linear data structures	5														
9	17CS2103	1	Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving	1	2													
		2	Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.	2	2													
		3	Be able to use effectively algebraic techniques to analyze basic discrete structures and algorithms.	2	2		2											
		4	Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples		2			2	2									
10	17EE2105	1	Understand the circuit elements and AC fundamentals for electrical networks	2				2										
		2	Apply Network theorems to Electrical networks (AC & DC)	2				2										
		3	Analyse the Two port networks, Resonance & Transients	2				2										
		4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction	2				2										

11	17EC1101	1	Discuss the various applications of electronics in everyday lives and Introduction to basic components.	2	2			2											
		2	Understand various types of Displays and Sensors and usage in everyday life.	2															
		3	Understand the usage of diodes, motors and Regulators in design of electronic applications.	1	2			2											
		4	Understand the Process, Interfacing and Parameters to be considered in design of Electronic Applications	2				2											
		5	Implement the Basic Components, Sensors and Communication Modules using Arduino	2				2											
PROFESSIONAL CORE COURSES																			
1	17EC2101	1	Analysing various diode-based circuits	3	3														
		2	Demonstrating working principles of BJT and JFET, Design of BJT amplifier, feedback amplifiers	3	3														
		3	Demonstrating the Linear & Non-linear applications of OPAMPs, filters	2	2														
		4	Design of the concepts of oscillators		2		2												
		5	Design and Testing of Analog circuits				3												
2	17EC2102	1	Understand the circuit elements and AC fundamentals for electrical networks	3		2													
		2	Apply Network theorems to Electrical networks (AC & DC)	3		2													
		3	Analyse the Two port networks, Resonance & Transients	3		2													
		4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction			3	2												
		5	Design and development of application oriented lab based experiments				2												
3	17EC2103	1	Understand the representation, manipulation and operations of Continuous-Time and Discrete Time signals and systems.	2															
		2	Explore the Continuous-Time signals in Fourier domain and illustration of sampling theorem.		2	2													

		3	Understand the Laplace Transforms and application to LTI systems.			2	2											
		4	Analyze Discrete Time signals in in Fourier and Z-Transform domain. Apply and evaluate signals and systems concepts to various applications under transform domain.			3	2											
		5	Design and verification of signal processing concepts through simulation software.				2											
4	17EC2204	1	Understand the circuit elements and AC fundamentals for electrical networks	1	2													
		2	Apply Network theorems to Electrical networks (AC & DC)	2	2													
		3	Analyse the Two port networks, Resonance & Transients	2	2													
		4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction		2		2											
5	17EC2205	1	Understand the Analysis of LTI Systems and Filters	1	2													
		2	Explore and Design the Digital filters: Digital IIR and FIR Filter			2												
		3	Explain the Realization of FIR filters and Systems		2		2											
		4	Analyze DFT and FFT			2	2											
		5	Understand the Analysis of LTI Systems and Filters	1				3										
6	17EC2206	1	have a good understanding of both time and frequency domain representations of signals;	1	2													
		2	have a good understanding of analog modulation and demodulation techniques;	1	2													
		3	have a good understanding of digital modulation and demodulation techniques; Understanding pulse modulation systems	1	2													
		4	Understand and be able to implement noise and Error analysis of an analogue system.		2		2											
		5	Experimentation and design of communication circuits through project based labs.				3											
7	17EC3107	1	Find basic networking models and functions of physical Layer		2													

		2	Define the functions of Data Link Layer in different networks		2													
		3	Find the functions of Network layer		2													
		4	To be familiar with the role of transport and application layers		2													
		5	To be able to simulate different networking devices			2												
8	17EC3108	1	Understanding basic concepts of electronics system design and recap of systems learnt so far	2														
		2	Learn how to specify electronic systems and understand their impacts on the performance. Also understand ESD design process		3													
		3	Students will get hand on experience on designing circuits and project of various complexities., analog and digital			3	3											
		4	Understanding the complete process of PCB hart-work design, fabrications and packaging and EMI/MC issues			3	3											
9	17EC3109	1	Able to understand and analyse the architectural features of CISC type of General purpose processor Intel 8086 Microprocessor.	2	2													
		2	Able to understand and analyse the architectural features of CISC type of microcontroller - Intel 8051 Microcontroller.	2	2													
		3	Able to understand and analyze the architectural features of RISC type of microcontroller – PIC Microcontroller.	2	2													
		4	Able to program 8086 microprocessor, 8051 and PIC microcontrollers in assembly language using TASM, KEIL, MPLAB and Proteus tools.		2		2											
10	17EC2212	1	Apply the principles of vector calculus to estimate the static Electric field due to different sources and Magnetic field due to various current sources	2														
		2	Develop the boundary conditions on E ,H fields and extend the concepts of static fields to obtain the governing laws of electromagnetic field. Perceive the propagation of uniform plane wave and its characteristics in different media.	2	2													

		3	Interpret the characteristics of the guided waves to understand the modes of propagation in wave-guides	2														
		4	Perceive the energy propagation over transmission lines involving measurement of power and impedance with an insight into appropriate matching techniques.	2	2													
	FLEXI CORE																	
1	17EC3301	1	Understand semiconductor device fabrication process and Analyze the characteristics of CMOS circuits Construction and the comparison between different state-of-the-art CMOS technologies and processes		2	2												
		2	Implement the a complete design verification process using computer-automated tools for scaling, layout, extraction, simulation, and timing analysis		2	2												
		3	Constructing the Transistor Level Logic circuits and understand the MOS layout design rules		2	2												
		4	Study of MOS circuit performance and testing principles			2	2											
		5	Create the MOS circuit modules through projectoriented approach using e-CAD tools					3										
2	17EC3302	1	Understand the Importance of RF Circuit Design, RF behaviour of passive components, Compare Types of Transmission Lines and represent Equivalent Circuits	1	1													
		2	Understand and analyse he RF diode, BJT and FET characteristics, and modelling amplifier input and output impedance matching with Graphical AID/Tool for RF Design;		2	2												
		3	Analyze Stability Considerations and stabilization methods to design RF Amplifiers Using Small Signal Analysis		2	2												
		4	Analyze high frequency oscillator configuration and mixer designs.			2	2											
		5	Analysis and design of RF electronic circuits			2	2											
3	17EC3303	1	Understand the basic concepts of wireless communications & GSM Technology	2	2													

		2	Understand the basic concepts of GPRS Architecture & modulation coding schemes		2	2												
		3	Understand the basic concepts of UMTS		2	2												
		4	Understand the basic concepts of 4G LTE			2	2											
4	17EC3304	1	To understand the concepts of Artificial Intelligence	1	2													
		2	To understand the concepts of neural networks		1	2												
		3	To elaborate machine learning methods		1	2												
		4	To understand the concepts of Fuzzy logic			2	2											
5	17EC3305	1	Understand the basics of measurement and calibration	1	1													
		2	Understand and study of various electronic instruments		2	2												
		3	Understand the basics of control systems and automation		2	2												
		4	Study and analysis of industrial automation			2	2											
		5	Design and development electronic measurement circuits suitable of automation			2	2											
6	17EC3307	1	Apply the Interfacing of Peripherals concepts of 8051 Microcontroller through programming.	3		3												
		2	Understand the basic architectures of ARM 7 & AVR microcontrollers and the basic concepts of CORTEX STM-32 microcontroller and RTOS.		2													
		3	Apply the applications of programming with Arduino Uno			3												
		4	Able to identify an architectural design of available technologies and solve the societal challenge using IoT.			2												
		5	Apply the Interfacing of Peripherals concepts of 8051 Microcontroller through programming.				2											
PROFESSIONAL ELECTIVES																		
ESS1	**EMBEDDED CONTROLLERS, IOTS & POWER ELECTRONICS**																	
1	17EC3611	1	Understanding of wireless sensor network technologies			3												
		2	Study of BLE protocols in WSN security and power applications.			2												

		3	Study and application of IOT and WSN for smart cities/ villages.			2												
		4	Study of various IoT application in various domains			2		1										
2	17EC3612	1	Understand the basics of solar photo-voltaic cell structure			3												
		2	Study of basic physics and components of solar photo voltaic cells			2												
		3	Study and design of solar PV systems and testing			2												
		4	Analysis and design of SPV arrays			2		1										
3	17EC3613	1	Understand the basics of renewable energy electronics			3												
		2	Study and analysis of electronics systems for renewable energy sources			2												
		3	Analysis and study of smart grid sub-systems and circuits			2												
		4	Analysis of electrical smart grids			2		1										
4	17EC3614	1	Understand the basics of smart cities/villages/living			3												
		2	Study of systems for smart cities with case studies.			2												
		3	Analysis and design of smart grid sub-systems and circuits			2												
		4	Study of advanced topics related to privacy, scaling and design considerations.			2		1										
ESS2	**VLSI & MICRO - ELECTRONICS**																	
1	17EC3621	1	Understand the power dissipation in MOS structure	1		1												
		2	Illustrate probabilistic power analysis and apply low power techniques at circuit level for CMOS circuits	1		3												
		3	Apply low power techniques for various combinational circuits.			1												
		4	Design and analysis of low power techniques for memories.			1	2											
2	17EC3623	1	Understanding of programmable IC design process and Verilog HDL	1		2												
		2	Understand and analysis of ASIC design and PLD's	1		2												
		3	Analysis and design of CPLD's and FPGA's			3												
		4	Analysis of modern IC's and chips			2	1											
3	17EC3624	1	Understand the design flow and methodologies of VLSI sub-system	3		1												
		2	Study of memory and array sub systems	1		1												

		3	Analysis of fault tolerant designs			1												
		4	Design of testing of VLSI systems			1	1											
ESS3	**AUTOMATION & ROBOTICS**																	
1	17EC3631	1	Understand the concepts of control systems	3														
		2	Analysis of control systems in time and frequency domains	1														
		3	Understanding the basics of robotics	1		1												
		4	Analysis and understanding of kinetics, dynamics and control of robots.	1		1												
2	17EC3632	1	Understanding the basics of autonomous vehicles	3														
		2	Understand the principles of sensors and actuators	1														
		3	Analysis and understanding of automotive electronic systems	1	1													
		4	Study of various miscellaneous topics	1	1													
3	17EC3633	1	Understanding the fundamentals of robotics	1														
		2	Analysis and understanding the various parameters of robots	1														
		3	Analysis and understanding the mechanisms involved in various robots.	1	1													
		4	Analysis of various case studies and humanoid applications of robots	1	1													
4	17EC3634	1	Understanding of the fundamental concepts related to multi-dimensional signal processing.	3														
		2	Understanding of the feature extraction, pattern analysis visual geometric modeling, stochastic optimization.	1														
		3	Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision.	1	1													
		4	Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering.					2										
5	17EC3635	1	Understand the Basic Idea of Human Machine Interactions, and its Goals	3														

		2	Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms	1														
		3	Understand the Basic Idea of Brain Machine Interactions, and brain waves	1	1													
		4	Apply an interactive design process and universal design principles to designing HCI/BMI systems	1	1													
ESS4	**SIGNAL PROCESSING**																	
1	17EC3641	1	Understand the basics of speech signal processing	3		2												
		2	Understand and applications of various transformation techniques for filter.	1		2												
		3	Understand the concepts and methods of aliasing, auto correct and filtering.	1		2												
		4	Analysis and understand advance topics in speech signal processing.					2										
2	17EC3642	1	Selected, as high level mathematics are used to model 2D complex systems; The principles of mathematics help solve Image Processing problems effectively.	3		2												
		2	Selected, to simulate algorithms for Systems using 2D methods	1		2												
		3	Selected, to create a problem identifier and learner, to find solutions in complex search space.	1		2												
		4	Selected, with simulations that can apply 2D models to solve Image processing problems.					2										
3	17EC3643	1	Understand What is Biomedical Imaging ? and its Importance ,Concepts of Image formation and Analysis are covered	1		3												
		2	Understand the Fundamentals of image formation and Major imaging modalities	1		2												
		3	Understand the modern bio-medical technologies.	1		2												
		4	Understand the advanced Application and its principles of the interpretation					2										
4	17EC3644	1	Understand the Random variables and random processes	1		3												

		2	Explain the estimation theory and methods of estimation criteria.	1		2												
		3	Explain and analyze the estimation of signal and spectral analysis	1		2												
		4	Explain the Kalman filters and Apply and evaluate Statistical signal processing concepts to various applications under transform domain.					2										
ESS5	**COMMUNICATION & WIRELESS**																	
1	17EC3651	1	Understand the basic concepts of coding methodology	1	3													
		2	Understand and evaluate different communication channels.	1	2													
		3	Analysis of various coding techniques	1		2												
		4	Analysis of various Error detection and correcting methods	1		2												
2	17EC3652	1	Understanding the concepts of multiple carrier systems	1	3													
		2	Understanding Spatial Multiplexing and its applications	1	2													
		3	Evaluate the performance of multicarrier systems	1	2													
		4	Understanding the basics of cellular communication	1	2													
3	17EC3654	1	Understand the basic concepts of optical communication	1	3													
		2	Analyze different optical sources, materials and structures	1	2													
		3	Evaluate different optical network protocols	1	2													
		4	Understand different optical networks	1	2													
ESS6	**DATA COMMUNICATION & NETWORKS**																	
1	17EC3661	1	Understand the basic concepts Internet Architecture	1	3													
		2	Able to Identify different configuration setups	1	2													
		3	Understand the concept of TCP and its design issues	1	2													
		4	Analysis of various protocols at each layer	1	2													
2	17EC3662	1	Understand the basic concepts Internet Telephony	1	3													
		2	Able to Identify different VoIP Architecture and protocols	1	2													
		3	Understand the concept of Broadband Services	1	2													
		4	Analysis of Optical Network and Multimedia concepts	1	2													

3	17EC3663	1	Understand the basic concepts 4G & 5G Technologies	1	3													
		2	Able to Identify different 5G Channels and Networking concepts	1	2													
		3	Understand the concept of 5G Evaluation and its Applications	1	2													
		4	Analysis of various IEEE standards	1	2													
ESS7	**RF, MICROWAVE & RADARS**																	
1	17EC3671	1	Able to Differentiate different Microwave components	1	3													
		2	Able to Identify transformers and microwave resonators	1	2													
		3	Understand the concept of design of different microwave filters	1	2													
		4	Analyse the applications of microwave and millimetric wave circuits		2	1												
2	17EC3672	1	Able to identify the radiation fields and antenna fundamentals	1	3													
		2	Able to Identify different types of antennas and arrays	1	2													
		3	Understand the concept of antenna measurements, design and testing.	1	2													
		4	Study of real-world applications of various antennas.					1										
3	17EC3673	1	Understand the essential principles of operation and design of simple radar systems and analysis of essential elements of Transmitters , Receivers and design of simple Radar Receiver	1														
		2	Understand various types of Radars	1	3													
		3	Understand the principles of various Radars systems used in different applications			1												
		4	Understand the basic concepts related to different systems and sensors for navigation.			1												
ESS8	**DATA-COMPUTING & APPLICATION TOOLS**																	
1	17EC3681	1	Understanding learning systems		3													
		2	Analyze unsupervised learning techniques		2	1												
		3	Analyze supervised learning techniques		2													
		4	Apply deep learning for real world problems		2													
2	17EC3682	1	Analysis of statistical methods for Big data		3													

		2	Understanding big data flat forms for large seal data storage		2	1												
		3	Analyze big data streaming flatforms for past data		2													
		4	Applying big data for real world flatforms		2													
3	17EC3685	1	Understanding of the fundamental concepts related to Video Surveillance.		3													
		2	Understanding of the feature extraction, pattern analysis visual geometric modelling.		2													
		3	Vehicle Tracking and Recognition, Human activity recognition		2	1												
		4	Applications range from Attribute-based people search, Age estimation from face, Gender recognition from face and body		2	1												
ESS9	**INSTRUMENTATION & BIO-MEDICAL ELECTRONICS**																	
1	17EC3691	1	Understand the basic components of Automotive Electronics		2													
		2	Understand the technology involved in autonomous vehicles	1	2													
		3	Analyse the security and control issues		2	1												
		4	Study of applications of modern instruments in Avionics	1	2													
2	17EC3693	1	Understand the cyber physical systems and major constituents.		3													
		2	Understand and study of various types of cyber physical systems.	1	2													
		3	Study of biological and silicon interfaces.		2	1												
		4	Study of various case studies and miscellaneous topics.	1	2													
SKILLING COURSES																		
1	17TS401	1	Introduction to GSD and LabVIEW Environment such as Front Panel, Controls Palette, Controls and Indicators, Block Diagram Terminals, Functions Palette, Data Type, Boolean Operations, String Operations.	1														
		2	Introduction to Loop Concept, Nested Loop, Feedback, Arrays, Cluster, Plotting Data using chart and Graph, Tunnel Concept, Introduction to parallelism, Local Variable, Global Variable, Property Nodes, Invoke Nodes using LabVIEW.	2	2													

		3	Introduction to Case structures, Case Control using Enumerated data type, Introduction to Flat Sequence, Create New Sub VI, Input and Output Sub VI Connectors, Error handling and Debugging Techniques, Introduction to File I/O operations, Event Structure and operations, Design Technique, Introduction to Architecture, Synchronization and Communication using LabVIEW.	2	2													
		4	Simulation Using MultiSim Isntruments such as Multimeter, Function Generator, Wattmeter, Bode plotter, Introduction to Measurement Probe and Current Probe in MultiSim, Operations on Simulation Analysis such as AC analysis, DC operating Point, Fourier Analysis, Noise Analysis, Distortion Analysis, Parameter Sweep, Transfer Function, Worst case Execution using MultiSim	2	2													
2	17TS402	1	Understand the array, indexing operations in Matlab and python. Understand the Analysis of LTI Systems and Filters	2														
		2	Apply DFT and FFT in speech and bio-signal processing.		2													
		3	Explore Multi-rate Signal Processing and Apply Wavelet transform for statistical feature extraction.		2													
		4	Explore ANN classifier, Apply Wavelet transform, ANN for classification		2													
3	17TS403	1	Introduction to VLSI, VLSI Design Flow, Applications and Advantages of VLSI, Introduction to EDA Xilinx ISE, Introduction to Basic Electronics: Number Systems, Binary Arithmetic, Boolean Algebra, Introduction to Basic Logic Gates ,Code Conversions: Binary to Grey , Grey to Binary, Excess -3 Codes and combinational circuits	1												1		
		2	Introduction to Verilog , HDL implementation Cycle, Verilog Keywords and identifiers , Port Declarations , Levels of modelling , Hierarchal Design , vector declarations, Language conventions Datatypes, Operators, Dataflow modelling examples,	2	2											2		

		3	Structural modelling using primitives , Component Instantiations , Port connection rules, Behavioural modelling introduction, Procedural blocks ,sensitivity list ,Conditional statements, Loops, combinational circuits adders and multiplexers, Demultiplexers, encoders and decoders design using HDL	2	2											2	
		4	Test benches, Delay statements , Test bench Structure , Components of Test bench, Example Test bench codes operations , Sequential circuits design, Blocking statements, non-blocking statements ,blocking vs non-blocking statements ,shift registers ,counters examples Coding design guidelines ,common errors and corrections ,synthesis and simulation mismatch, FSM modelling. Hands on Experience on FPGA Boards (Dumping and Testing Process)	2	2											2	
4	17TS404	1	Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create the file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre-layout simulation.	1														
		2	Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation.	2	2													
		3	Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, learning of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino	2	2													
		4	Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV, and different simulators.	2	2													
5	17TS405	1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	1	1	1	1											
		2	Express different Decision Making statements and Functions					1	1	1	1							

		3	Interpret Object oriented programming in Python Understand and summarize different libraries and packages							1	1	1	1				
		4	Explain how to use java effectively in all data types, array, functions, and search											1	1	1	1
6	17TP3101	1	Basic Building Block concepts of Programming related to Input-Output function, If-Else and Nested If-Else. And the problems related to it.		3											3	
		2	Basic Building Block concepts of Programming related to Switch Case, For loop, while loop, break, Continue,Goto, Functions and Recursions. And the problems related to it.		3											3	
		3	Basic Building Block concepts of Programming related to Arrays, Strings, Sorting and Searching. And the problems related to it.		3											3	
		4	Basic Building Block concepts of Programming related to Structures, Linked List, Queue, Stack and Greedy. And the problems related to it.		3											3	
7	17TP3202	1	Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre layout simulation.	1													
		2	Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation.	2	2												
		3	Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, laering of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino	2	2												
		4	Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV, and different simulators.	2	2												
TERM PAPER & PROJECT																		
1	17IE2246		INDUSTRIAL TRAINING									3						

2	17IE3247	5	The term paper has to be taken up by the VI Semester students. It is based on independent research in one of the areas opted by the student. In a term paper, a student should demonstrate his/her ability in finding out the relevant sources, selection, an illustration of logic, and in organizing the information on the topic, gathering the data, processing, analyzing, and summarizing.	3	3	3	3	3	3	3							
3	17IE4048	5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the student.					3		3				3		3	
4	17IE4049	5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the student.					3		3				3		3	
5	17IE4050	5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-today task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the student.	3	3	3	3	3	3	3							3

6	17IE4051	5	The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-today task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the student.	3	3	3	3	3	3	3								3

									PO												PSO	
SNO	COURSE CODE	COURSE NAME	L	T	P	S	Cr	Pre-requisite	1	2	3	4	5	6	7	8	9	10	11	12	1	2
		HUMANITIES & SOCIAL SCIENCES																				
1	17EN1201	Building Blocks for Communication Skills	0	0	4	0	2	Nil									2			2		
2	17EN3102	Instant Communication Skills	0	0	4	0	2	Nil							2					2		
3	17UC2204	Aptitude Builder - 1	0	0	4	0	2	Nil	2				2	2	2			2				
4	17UC3105	Aptitude Builder - 2	0	0	4	0	2	Nil	2				2			2		2				
5	17UC0007	Indian Heritage and Culture	2	0	0	-	0	Nil						2								
6	17UC0008	Indian Constitution	2	0	0	-	2	Nil						1	2		3					
7	17UC0009	Ecology and Environment	2	0	0	-	0	Nil	2		2											
8	17AC1008	Universal Human Values & Professional Ethics	2	0	0	0	0	Nil								1						
II		**BASIC SCIENCES**																				
1	17BT1001	Biology for Engineers	2	0	0	-	2		2		2	2				2				2		
2	17CY1001	Engineering chemistry	3	0	2	-	4			3	4											
3	17MT1101	Single variable calculus and matrix algebra	3	0	2	-	4		2	2												
4	17MT1102	Foundations of computational mathematics	3	0	0	-	3		2										1			
5	17MT1203	Multivariate calculus	3	0	2	-	4		3													
6	17MT1204	Logic and reasoning	3	0	0	-	3		2		2											
7	17PH1001	Engineering materials	2	1	2	-	4		1													
8	17MT2009	Probability and Stochastic Processes	2	1	0	0	3		3													
III		**ENGINEERING SCIENCES**																				
1	17ME1001	Engineering Mechanics	3	0	2	0	4			2												
2	17CS2004	Object Oriented Programming	3	0	2	0	4		2	2												
3	17CS1102	Data Structures	3	0	2	0	4		2	2		2										
4	17ME1003	Workshop Practice	0	0	2	0	1				2	2	2									
5	17CS1101	Problem Solving and Computer Programming	2	2	2	0	5		1	2		2								1		
6	17ME1002	Engineering Graphics	1	0	4	0	3		2											2		
7	17GN1003	Basic engineering measurements	2	0	2	0	3		2		3											
8	17GN1204	Coding Skills for Engineers	0	0	10	0	5	NIL	5	4												
9	17CS2103	Discrete Mathematics	2	1	0	0	3		2	2		2	2	2								

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10	17EE2105	Electrical Circuit Theory	3	1	0	0	4		2				2										
11	17EC1101	Introduction to Electronics Engineering	2	0	2	0	3		2	2			2										
PROFESSIONAL CORE COURSES																							
1	17EC2101	Analog Electronic Circuit Design	3	0	4	0	5		3	3		3											
2	17EC2102	Digital System Design	3	0	2	0	4		3		3	2											
3	17EC2103	Signals and Systems	3	0	2	0	4		2	2	3	2											
4	17EC2204	Computer Organization and Architecture	3	0	0	0	3		2	2		2											
5	17EC2205	Digital Signal Processing	2	1	2	0	4		1	2	2	2	3										
6	17EC2206	Analog and Digital Communication	2	1	2	0	4		1	2		3											
7	17EC3107	Computer Networks	3	0	2	0	4			2	2												
8	17EC3108	Electronic System Design Workshop	2	0	4	0	4		2	3	3	3											
9	17EC3109	Processors and Controllers	2	1	2	0	4	Nil	2	2		2											
10	17EC2212	Electromagnetic Fields and Transmission Lines	3	0	0	0	3	17 EC 2103	2	2		2											
	FLEXI CORE																						
1	17EC3301	VLSI Design	3	0	2	0	4	17EC2101		2	2	2	3										
2	17EC3302	RF System Design	3	0	2	0	4	17EC2212	1	2	2	2											
3	17EC3303	Wireless Communication	3	0	2	0	4	17EC2206	2	2	2	2											
4	17EC3304	AI, ANN & ML	3	0	2	0	4	NIL	1	2	2	2											
5	17EC3305	Electronic Instruments, Automation & Biomedical Applications	3	0	2	0	4	NIL	1	2	2	2											
6	17EC3307	Embedded Controllers	3	0	2	0	4	NIL	3	2	3	2											
		PROFESSIONAL ELECTIVES																					
ESS1	**EMBEDDED CONTROLLERS, IOTS & POWER ELECTRONICS**																						
1	17EC3611	Wireless sensor Networks & IOT Applications	3	0	0	0	3	NIL			3		1										

2	17EC3612	Solar Photo-Voltaic cells & Solar Power Arrays	3	0	0	0	3	NIL			3		1										
3	17EC3613	Electronic Systems for Renewable Energy & Smart Grid	3	0	0	0	3	NIL			3		1										
4	17EC3614	IOT Applications for Smart Cities	3	0	0	0	3	NIL			3		1										
ESS2	**VLSI & MICRO - ELECTRONICS**																						
1	17EC3621	Low Power VLSI	3	0	0	0	3	NIL	1		3	2											
2	17EC3623	IC Design & Applications	3	0	0	0	3	NIL	1		3	1											
3	17EC3624	VLSI Sub-system Design and Design for Testability	3	0	0	0	3	NIL	3		1	1											
ESS3	**AUTOMATION & ROBOTICS**																						
1	17EC3631	Control Systems & Introduction to Robotics	3	0	0	0	0	NIL	3		1												
2	17EC3632	Autonomous Vehicles & Automotive Electronics	3	0	0	0	0	NIL	3	1													
3	17EC3633	Advanced Robotics	3	0	0	0	0	NIL	1	1													
4	17EC3634	Computer Vision & Applications	3	0	0	0	0	NIL	3	1			2										
5	17EC3635	Human Machine Interface & Brain Machine Interface	3	0	0	0	0	NIL	3	1													
ESS4	**SIGNAL PROCESSING**																						
1	17EC3641	Speech Signal Processing	3	0	0	0	0	NIL	3		2		2										
2	17EC3642	Digital Image Processing	3	0	0	0	0	NIL	3		2		2										
3	17EC3643	Biomedical Image Processing	3	0	0	0	0	NIL	1		3		2										
4	17EC3644	Statistical Signal Processing	3	0	0	0	0	NIL	1		3		2										
ESS5	**COMMUNICATION & WIRELESS**																						
1	17EC3651	Information Theory & Coding	3	0	0	0	0	NIL	1	3	2												
2	17EC3652	4G Wireless Technologies & Cellular Communications	3	0	0	0	0	NIL	1	3													
3	17EC3654	Optical Communication Networks	3	0	0	0	0	NIL	1	3													
ESS6	**DATA COMMUNICATION & NETWORKS**																						
1	17EC3661	TCP/IP Protocol Suite	3	0	0	0	0	NIL	1	3													
2	17EC3662	VoIP Systems & Broad Band Networks	3	0	0	0	0	NIL	1	3													

3	17EC3663	5G Mobile, Wireless Technologies & IEEE 802 Standards	3	0	0	0	0	NIL	1	3													
ESS7	**RF, MICROWAVE & RADARS**																						
1	17EC3671	Microwave Engineering	3	0	0	0	0	NIL	1	3	1												
2	17EC3672	Antenna Design & Wave Propagation	3	0	0	0	0	NIL	1	3			1										
3	17EC3673	Radar Engineering & Navigational Aids	3	0	0	0	0	NIL	1	3	1												
ESS8	**DATA-COMPUTING & APPLICATION TOOLS**																						
1	17EC3681	Machine Learning	3	0	0	0	0	NIL		3	1												
2	17EC3682	Data Sciences & Big-Data	3	0	0	0	0	NIL		3	1												
3	17EC3685	Video Surveillance	3	0	0	0	0	NIL		3	1												
ESS9	**INSTRUMENTATION & BIO-MEDICAL ELECTRONICS**																						
1	17EC3691	Autonomous Vehicle & Avionics	3	0	0	0	0	NIL	1	2	1												
2	17EC3693	Biological & Cyber-Physical Systems	3	0	0	0	0	NIL	1	3	1												
SKILLING COURSES																							
1	17TS401	Technical Skilling-1 (Lab View and MultiSim)	0	0	0	6	1.5	NIL	1	2													
2	17TS402	Technical Skilling-2(Matlab) (Communications and DSP)	0	0	0	8	2	NIL	2	2													
3	17TS403	Technical Skilling-3 (VLSI-Xilinx-Vivado, ES-Keil&ARM, SP-Python, CS-Tems, IOT-Python, ML&AI-Keras)	0	0	0	8	2	NIL	2	2										2			
4	17TS404	Technical Skilling-4 (VLSI-Mentor Graphics, ES-Python& RasberriPie, SP-Python, CS-BTS simulators, IOT-Open CV, ML&AI-Tensor Flow)	0	0	0	6	1.5	NIL	2	2													
5	17TS405	Technical Skilling-5 (VLSI-Pspice or Cadence, ES-CC Studio, SP-VC++, CS-HFSS-CST, ML&AI-Spider)	0	0	0	6	1.5	NIL	1	2			3										
6	17TP3101	Technical Proficiency & Training -1	0	0	0	4	1	NIL		3											3	3	
7	17TP3202	Technical Proficiency & Training -2	0	0	0	8	2	NIL	2	2													
TERM PAPER & PROJECT																							

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1	17IE2246	INDUSTRIAL TRAINING	0	0	4	0	2	NIL									3						
2	17IE3247	TERM PAPER	0	0	4	0	2	NIL	3	3	3	3	3	3	3								
3	17IE4048	PROJECT (PART I)	0	0	0	24	6	NIL					3		3				3		3		
4	17IE4049	PROJECT (PART II)	0	0	0	24	6	NIL					3		3				3		3		
5	17IE4050	PRACTICE SCHOOL	0	0	0	24	6	NIL	3	3	3	3	3	3	3								3
6	17IE4051	INTERNSHIP	0	0	0	24	6	NIL	3	3	3	3	3	3	3								3
COUSNELLING & CO-CURRICULAR																							
1	17GN2103	Counselling-1	0	0	1	0	0																
2	17GN2204	Counselling-2	0	0	1	0	0																
3	17GN3105	Counselling-3	0	0	1	0	0																
4	17GN2109	Co-curricular-1	0	0	0	2	0.5																
5	17GN2210	Co-curricular-2	0	0	0	2	0.5																
OPEN ELECTIVES																							
1	OE-1	OPEN ELECTIVE-1	3	0	0	0	3																
2	OE-2	OPEN ELECTIVE-2	3	0	0	0	3																
4	OE-4	MANAGEMENT ELECTIVE	3	0	0	0	3																
5	OE-5	FOREIGN LANGAUGE ELECTIVE	2	0	0	0	2																
SNO	**COURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**S**	**Cr**	**Pre requisites**															
LIST OF OPEN ELECTIVES																							
1	17BT40A1	IPR & PATENT LAWS	3	0	0	0	3	NIL															
2	17CE40A2	ENVIRONMENTAL POLLUTION CONTROL METHODS	3	0	0	0	3	NIL															
3	17CE40A3	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	0	0	0	3	NIL															
4	17CE40A4	REMOTE SENSING & GIS	3	0	0	0	3	NIL															

5	17CE40A5	DISASTER MANAGEMENT	3	0	0	0	3	NIL																
6	17CS40A6	FUNDAMENTALS OF DBMS	3	0	0	0	3	NIL																
7	17CS40A7	FUNDAMENTALS OF SOFTWARE ENGINEERING	3	0	0	0	3	NIL																
8	17CS40A8	FUNDAMENTALS OF INFORMATION TECHNOLOGY	3	0	0	0	3	NIL																
9	17EC40A9	IMAGE PROCESSING	3	0	0	0	3	NIL																
10	17EM40B1	LINUX PROGRAMMING	3	0	0	0	3	NIL																
11	17EM40B2	E-COMMERCE	3	0	0	0	3	NIL																
12	17EE40B3	RENEWABLE ENERGY SOURCES	3	0	0	0	3	NIL																
13	17ME40B4	ROBOTICS	3	0	0	0	3	NIL																
14	17ME40B5	MECHATRONICS	3	0	0	0	3	NIL																
15	17ME40B6	OPERATIONS RESEARCH	3	0	0	0	3	NIL																
16	17PH40B7	NANO MATERIALS & TECHNOLOGY	3	0	0	0	3	NIL																
17	17PE40B8	SUBSEA ENGINEERING	3	0	0	0	3	NIL																
18	17PE40B9	OIL AND GAS MANAGEMENT	3	0	0	0	3	NIL																
19	17GN40C1	SELF-DEVELOPMENT	3	0	0	0	3	NIL																
20	17GN40C2	INDIAN CULTURE AND HISTORY	3	0	0	0	3	NIL																
21	17GN40C3	EMOTIONAL INTELLIGENCE	3	0	0	0	3	NIL																
22	17GN40C4	PROFESSIONAL ETHICS AND VALUES	3	0	0	0	3	NIL																
23	17GN40C5	BEHAVIOURAL SCIENCES	3	0	0	0	3	NIL																
24	17GN40C6	GENDER SENSITIZATION	3	0	0	0	3	NIL																
LIST OF MANAGEMENT ELECTIVES																								
1	17MB4051	PARADIGMS IN MANAGEMENT THOUGHT	3	0	0	0	3	NIL																
2	17MB4052	INDIAN ECONOMY	3	0	0	0	3	NIL																
3	17MB4053	MANAGING PERSONAL FINANCES	3	0	0	0	3	NIL																
4	17MB4054	BASICS OF MARKETING FOR ENGINEERS	3	0	0	0	3	NIL																

5	17MB4055	ORGANIZATION MANAGEMENT	3	0	0	0	3	NIL																
6	17MB4056	RESOURCES SAFETY AND QUALITY MANAGEMENT	3	0	0	0	3	NIL																
7	17MB4057	ECONOMICS FOR ENGINEERS	3	0	0	0	3	NIL																
LIST OF FOREIGN LANGUAGES																								
1	17GN3051	ARABIC LANGUAGE	3	0	0	0	3	NIL																
2	17GN3052	BENGALI LANGUAGE	3	0	0	0	3	NIL																
3	17GN3053	CHINESE LANGUAGE	3	0	0	0	3	NIL																
4	17GN3054	FRENCH LANGUAGE	3	0	0	0	3	NIL																
5	17GN3055	GERMAN LANGUAGE	3	0	0	0	3	NIL																
6	17GN3056	HINDI LANGUAGE	3	0	0	0	3	NIL																
7	17GN3057	ITALIAN LANGUAGE	3	0	0	0	3	NIL																
8	17GN3058	JAPANESE LANGUAGE	3	0	0	0	3	NIL																
9	17GN3059	KANNADA LANGUAGE	3	0	0	0	3	NIL																
10	17GN3060	RUSSIAN LANGUAGE	3	0	0	0	3	NIL																
11	17GN3061	SIMHALI LANGUAGE	3	0	0	0	3	NIL																
12	17GN3062	SPANISH LANGUAGE	3	0	0	0	3	NIL																

SYLLABUS A.Y. 2017-18
HUMANITIES AND SOCIAL SCIENCES
BUILDING BLOCKS FOR COMMUNICATION SKILLS

Course code: 17 EN 1201 **L-T-P-S: 0-0-4-0**
Pre Requisite: NIL **Credits: 2**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcomes	PO	BTL
1	Improve pronunciation skills and understand the method of identifying antonyms.	9	2
2	Apply writing strategies for office/ formal communication	12	2
3	Analyze types of reading techniques and improve reading speed.	9	2
4	Analyze different cultures and the importance of empathy in cross-cultural communication.	9,12	2

Listening & Speaking Skills: Phonetics symbols- practice- Exercises - Pronunciation- Reading Cum Speaking Practice: Enunciation- Homonyms- Homophones- Homographs: Vocabulary- Root words- Affixes- Identifying meaning from context- Synonyms & Antonyms: Word building: Escatalk**: Speaking** to persuade: Pyramid Discussion**:** Story- Telling and interpretation: End story: Speaking to Explain: Tell me why?
General Writing Skills: Clarity and conciseness in writing: Paragraph Writing: Identifying Topic sentences, writing topic sentence: Linkers, Coordinates: Letter Writing & E- Mail Writing: Netiquette
Reading Skills: Reading comprehension Practice Exercises: Reading for information: Reading for specifics --- theme, attitude: Types of Reading: Vertical Reading: Identifying the central idea**:** Speed Reading --- seven techniques to improve reading speed
Soft Skills: Introduction to soft skills: Verbal and Non-verbal communication: Cultural sensitivity: Empathy and understanding: Diversity and Acculturation

Reference Books

1. English pronunciation in use: Intermediate, 2nd edition, Mark Hancock and Sylvie Donna, Cambridge publication.
2. Speaking English Effective (English) 2nd Edition, Krishna Mohan & N P Singh, Laxmi Publications-New Delhi, 2005 print.
3. The Ace of Soft Skills, Mr. Gopalaswamy Ramesh et al, Pearson publishers, 2010 print.
4. Effective speech, Richard W.Clark, Glencoe Pub. Co., 1988 Print.
5. Effective Business Communication, Asha Kaul, PHI Learning Private Limited, New Delhi, 2011

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INSTANT COMMUNICATION SKILLS

Course code: 17 EN 3102 **L-T-P-S: 0-0-4-0**
Pre Requisite: NIL **Credits: 2**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcomes	PO	BTL
1	Improve pronunciation skills and understand the method of identifying antonyms.	7,12	2
2	Apply writing strategies for office/ formal communication	12	2
3	Analyze types of reading techniques and improve reading speed.	7	2
4	Analyze different cultures and the importance of empathy in cross-cultural communication.	7,12	2

Speaking & Listening Skills: Group Discussions: Know yourself as a Communicator**:** Communicating with others**:** Format of GD as used in national level recruitment boards**:** Rules, ambience and normal practices**:** Do's and Don't s in Group Discussions: Helping to build confidence, improve on content and clarity**:** Practicing skills like Initiating, developing and concluding discussions

Structures and Written Expression: Sentence Completion: Writing Proposals: Product and process description: Agenda, Minutes and Scheduling meetings: Technical Writing Skills: Report Writing: Types of reports, Formats and how to write good reports.

READING SKILLS: Reasoning Skills: Analytical Reasoning: Critical Reasoning: Language Specific Reasoning: Vocabulary in context: Signpost words: Pejorative Signals and Complimentary Signals: Continuation Signals: Contrast signals: Sentence Completion: Text completion: Sentence Equivalence.

SOFT SKILLS: Seminars & Presentations: People Skills: Initiating and ending conversations: Expressing and creating interest: Initiating and ending conversations: Breaking good/bad news

Text Books

1. Professional Communication, Aruna Koneru, Tata Mc Graw- Hill Publishing Company, New Delhi, 2008 Print..
2. Technical Writing Process and Product (third edition), Sharon J. Gerson, Steven M Gerson, Pearson Education, Asia.
3. Developing Reading Skills: A Practical Guide to Reading Comprehension Exercises, Frangoise Grelle. Cambridge University Press, 1981.
4. Study Reading: A Course in Reading Skills for Academic Purposes, Eric H. Glendinning, Beverly Holmström, Cambridge University Press, 2004.
5. Reasoning and Reading Level 1, Joanne Carlisle, School Specialty Intervention, 1999
6. Presentation skills. The essential guide for students, Patsy Mc Carthy & Caroline Hatcher, Sage publications, 2002.
7. Business Communication : Connecting in a Digital World, Raymond V.Leisikar, Marie. E. Flatley et al. Mc Graw Hill Education, 13 Edition, 2015 print.

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

APTITUDE BUILDER –I

Course Code: 17UC2204 **L-T-P-S: 0-0-4-0**
Pre Requisite: NIL **Credits: 2**
Mapping of Course outcomes with Program Outcomes:

CO	Course outcome's	PO	BTL
1	Apply the concept of Critical Reading and Analytical Reading and comprehend the key ideas and gist of a passage. Understand the importance of the presentation skills, analyze the given topic, apply various strategies and the principles of grammar in written expression.	5,6	2
2	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.	7,10	2
3	Apply the concepts of Numbers to solve the problems related to divisibility rules, problems based on Unit's digit, Remainders, Successive Division, Prime Factorization, LCM & HCF problems. Apply the concepts of Averages &Alligations, students will be able to solve the problems related to Averages as well as problems based on Mixtures.	1, 5	2
4	Apply the various concepts of cubes to find out how to cut a cube to get the maximum number of smaller identical pieces, how to minimize the number of cuts required to cut a cube into the given number of smaller identical pieces, how to count the number of smaller cubes which satisfy the given painting scheme. Apply the principles of binary logic to solve problems involving truth-tellers, liars and alternators. Analyze the given data to form an ordered arrangement from an unorganized raw data.	1, 5	2

Directed Listening and Thinking Activity (DLTA) Skills: Reading, Listening, Thinking, Writing, Presentation - Method: Flipped Classroom Writing Skills**:** Paraphrasing, Summarizing, Notice, Circular, Agenda, Minutes, Memo. **Body Language (Kinesics)** :Postures, gestures, eye contact Self-confidence: Self-esteem Soft Skills: The Art of Compromise, Learn to Say: "I Don't Know", Being organized, Showing Self-awareness, An eye on success, being self-motivated, Showing self-awareness, Find Direction from Someone Who Is Lost: "The Drifter Self-Assessment for Attainable Career Objectives--Defining a Career Objective, **Quantitative Aptitude**: Numbers, Averages and Alligations, Mensuration **Reasoning:** Cubes, Binary Logic, Ordering and Sequencing

Reference Books:

1. Daniel G.Riordan and Steven E. Pauley: Technical Report Writing Today. New Delhi: Biztantra.2004.
2. Ken Taylor. Telephoning and Teleconferencing Skills. Hyderabad:Orient Black Swan.2008.
3. E. Suresh Kumar, B. Sandhya. Communication for Professional Success. Delhi: Orient Black Swan.2013
4. Reasoning *Trainer Plus*.: Hyderabad: Brain Mapping Academy.2012

APTITUDE BUILDER-2

Course Code: 17UC3105 **L-T-P-S: 0-0-4-0**

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Pre Requisite: NIL **Credits: 2**

Mapping of Course outcomes with Program Outcomes:

CO No	Course outcome's	PO	BTL
1	Apply the strategies and techniques learnt in carrying out conversations in different contexts. Analyse the different parameters and formats of written technical communication and apply in everyday work and life.	8, 10	2
2	Analyse the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.	8, 10	2
3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest, students will be able to solve the problems based on Ratios, problems involving Percentages, problems related to cost price, selling price, profit, loss, marked price and discounts, problems involving interest.	1, 5	2
4	Analyse the given series of numbers to predict the next number in the series. Analyse the given set of numbers or letters to find the analogy. Analyse the given data to find the code which is used to encode a given word and use the same code in the process of decoding. Apply the given set of conditions to select a team from a group of members.	1	2

Critical Reading: Reading to Identify the Theme, Reading to Identify the Central Idea; Reading to Identify the Tone, Reading to Identify Writer's Attitude, Reading to Identify Parallel Ideas, Reading to Identify Logical Conclusions. Writing Skills: Note- making and Note- taking, Report Writing. Presentation Skills- Preparing for the Presentation, Audience Analysis, Processing Information, Ice-breakers, Quotations, Presentation Structure, Say what you want to say- Say it, Say what you have said to say, Preparing for Question Hour,Funnel Effect and How to Overcome it. Trinity Guild Hall - Communication Skills - Graded Evaluation and Testing-1-8 grades. Quantitative Aptitude: Ratio and Proportion, Percentages, Profit and Loss, Simple Interest and Compound Interest. Reasoning: Number and Letter Series, Number and Letter Analogy, Coding and decoding, Odd man out. Selections.

Reference Books

1. Dr. Meenakshi Raman and Dr. Sangeetha Sarma: *Technical Communication*.Oxford University Press: Delhi.2016.
2. M. Ashraf Rizvi: *Effective Technical Communication.* New Delhi:McGraw Hill Education(India) Private Limited
3. Tom Rath: Strengths Finder2.0. New York:Gallup Press.2007.
4. C. Weaver. *Reading Process and Practice*. Portsmouth US: Heinemann Educational Bokks.1988.

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INDIAN HERITAGE & CULTURE

COURSE CODE: 17UC0007 **L-T-P-S: 2-0-0-0**
Pre Requisite: NIL **Credits: 0**

CO No	Course outcome's	PO	BTL
1	Familiarizing students with various aspects of Indian culture and how they contribute to the concept of Unity in Diversity	6	2
2	Understand the beginnings of Indian History and the developments during the Ancient period	6	2
3	Understand the developments in India during the Medieval Age along with how they contributed to Indian civilization	6	2
4	Understand the reasons for colonial rule over India and how independence was achieved from British rule	6	2

Introduction-Concept of Culture-Culture and Civilization-General Characteristics of Indian Culture-Importance of Culture-Unity in Diversity. History and Culture through the Ages – Fundamental Unity of Harappan and Vedic Culture – Jainism and Buddhism-Mauryan Period-Post-Mauryan Period-Gupta Period-Pallavas and Cholas. Advent of Islam in India-Islam and Sufism-Islamic Art and Architecture-Bhakti Movement-Vijayanagar Period-Art and Architecture and Literature. Rise of the West and its impact on India-Social and Religious reformers in the 17th and 19th centuries-Press and growth of modern Indian literature-Rise of Indian Cinema-Indian Independence

Reference Books:

1. Facets of Indian Culture- Spectrum Publications
2. Ancient India: National Council of Educational Research and Training
3. Medieval India: Part I & Part II: National Council of Educational Research and Training.
4. Modern India: National Council of Educational Research and Training.
5. An Advance History of India: R.C. Majumdar, H.C. Raychaudhuri & Kalikinkar Datt: Macmillan India Ltd.
6. The Wonder that was India : A.L.Bhasham.

INDIAN CONSTITUTION

COURSE CODE: 17UC0008 **L-T-P-S: 2-0-0-0**
Pre Requisite: NIL **Credits: 2**

Mapping of Course outcomes with Program Outcomes:

CO No	Course outcome's	PO	BTL
1	To understand Constitutional development after Independence	6,7,9	1
2	To learn the fundamental features of the Indian Constitution	6,7,9	2
3	To get a brief idea of the powers and functions of Union and State Governments	6,7,9	3
4	To understand the basics of working of Indian Judiciary and the Election Commission	6,7,9	1

Making of the Constitution: A brief analysis of National Movement. Constitutional Development with reference to Government of India Act 1909, 1919, 1935 and Indian Independence Act 1947. The Constituent Assembly of India. **Basic features of the Indian Constitution:** the Preamble, Fundamental Rights, Directive Principles of State Policy – Fundamental Duties **Government of the Union** : The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions, The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers and functions – the role of the Speaker. **Government of the State :**The Governor – the Council of Ministers and the Chief Minister – Powers and Functions, The State Legislature – composition, powers and functions. **The Indian Judicial System:** the Supreme Court and the High Courts – composition, Jurisdiction and functions, Judicial review, Judicial activism, Independence of Judiciary In India. **Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners

Reference Books:

1. Indian Polity' by Laxmikanth
2. Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti
5. 'Constitutional Law of India' by Seervai H.M.
6. 'Constitution Of India' by Shukla V.N.
7. 'The Indian Constitution: Cornerstone of a Nation' by Granville Austiin
8. 'Indian Constitutional Law' by M.P. Jain

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ECOLOGY AND ENVIRONMENT

Course Code: 17UC0009 **L-T-P-S: 2-0-0-0**

Pre Requisite: NIL **Credits: 0**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	CO	PO	BTL
CO 1	Understand the importance of environmental education and the conservation of natural resources.	1,3	2
CO 2	Understanding the importance of ecosystems and biodiversity.	1,3	2
CO 3	Understanding the environmental pollution.	1,3	2
CO 4	Understanding the solid waste management, disaster management and EIA process.	1,3	2

Syllabus: The Multidisciplinary nature of Environmental Studies - Introduction to Environment, Definition, scope ,importance, Multidisciplinary nature of Environmental Studies, Need for public awareness. Institutions and people in Environment. Natural Resources- Renewable and Non Renewable Resources Forest resources - Benefits, Deforestation, causes, effects and impacts, Afforestation programmes, Socio-forestry, Agro-forestry, Vanasamrakshana programmes,. Mining its impact on environment - mining, dams and their effects on forests and tribal people. Water resources-Distribution of surface and ground water, Aquifers, floods, drought, conflicts over water, dams, benefits and problems, Water conservation, rain water harvesting, watershed management, Cloud seeding Mineral resources- Use, exploitation, environmental effects. Food resources- Changes in agricultural methodologies, comparison between old and new methods of farming, Green Revolution, Environmental Impact Assessment of conversion of agricultural lands, effects of modern agriculture, Drip Irrigation, fertilizer, pesticide problems, Eutrophication, Vermi-compost, water logging, Blue baby syndrome. Energy resources - Growing energy needs, renewable and non renewable energy sources. Land resources-. Soil erosion- Importance of soil, Types of soil erosion, Causes and effects of soil erosion. How to control soil erosion. Role of an individual in conservation of natural resources. Ecosystems - Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem ,Ecological succession, Food chains, food webs and ecological pyramids. Types of ecosystem. Biodiversity and its Conservation-Introduction, Definition, Levels, Values of biodiversity, India as a mega diversity nation. Hotspots of biodiversity. Threats to biodiversity- Endangered and endemic species of India. Conservation of biodiversity- Assessment of Biodiversity and its impact on Environment. Environnemental Pollution- Definition, Causes, effects, control measures of Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste management. Electronic waste management, Biomedical waste management - Role of an individual in prevention of pollution. Disaster management–.Climate change, global warming, acid rain, ozone layer depletion. Environmental Legislation and objectives of Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife protection Act, Forest conservation Act, Biodiversity Act, Public awareness. Environmental Impact Assessment Process.

Text Books :

1. Anubha Kaushik, C.P.Kaushik, “Environmental Studies” , New Age International, (2007).
2. Benny Joseph, “Environmental Studies”, Tata McGraw-Hill companies, New Delhi, (2009).
3. Dr.S.Manjunathan, Dr.T.Maruthavanan, Mr.P.Subbramaniyan,”Environmental Science and Engineering (2009)

Reference Books :

1. Introduction to Ecology, Paul Colinvaux, 1973, Wiley International Edition.
2. Fundamentals of Ecology, E.P. Odum, 1971, W.B.Saunders & Co.

3. Essential of Ecology and Environmental Science, S.V.S.Rana, PHI Learning Private Ltd, Delhi.

Web Links :

1. https://nptel.ac.in/courses/120108005/module1/lecture1.pdf
2. https://nptel.ac.in/courses/105106056
3. https://nptel.ac.in/courses/104103020/module7/lec6/9.html
4. https://nptel.ac.in/courses/105103025/module3/lec25/2.html
5. http://nilex.com/sites/default/files/nilex-geosynthetic-clay-liners-gcl-specifications.pdf

UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

COURSE CODE: 17UAC1008 **L-T-P-S: 2-0-0-0**

Pre Requisite: NIL **Credits: 2**

Syllabus: Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - The Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations. **Harmony in the Human Being:** Understanding the Human Being as Co-existence of Self ('I') and Body, Discriminating between the Needs of the Self and the Body, The Body as an Instrument of 'I', Understand Harmony in the Self ('I'), Harmony of the Self ('I') with the Body, Program to Ensure Sanyam and Svasthya. **Harmony in the Family and Society:** Harmony in the Family - the Basic Unit of Human Interaction, Values in Human-to-Human Relationships, 'Trust' – the Foundational Value in Relationships, 'Respect' – as the Right Evaluation, Understand Harmony in the Society, Vision for the Universal Human Order. **Harmony in the Nature (Existence):** Understand Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing 'Existence is Co-existence' at All Levels, The Holistic Perception of Harmony in Existence. **Implications of the Right Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models - Typical Case studies, Strategies for Transition towards Value-based Life and Profession.

Text Book:

1. R R Gaur, R Sangal and G P Bagaria, " A Foundation Course in Human Values and Professional Ethics", 1st Ed, Excel Books.

BASIC SCIENCE COURSES

BIOLOGY FOR ENGINEERS

Course code: 17BT1001 **L-T-P-S: 2-0-0-0**

Pre-requisite: NIL **Credits: 2**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome	PO	BTL
1	Understand the basis of Life, Living organisms and human body systems	1,3,4,8	2
2	Understand the importance of Diet and Nutrition	1,3,4,8	2
3	Acquire the knowledge of beneficial and harmful Microorganisms and Biosensors	1,3,4,8	2
4	Understand the importance of Biosensors	1,3,4,8	2

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS: BASIC BIOLOGY: Introduction, Living organisms, Cell structure and Organelles, Organogenesis, Human Anatomy, Systems of Life: Digestion, Respiration, Circulation, Excretion, Reproduction, Thinking and coordination and Defense, Diet and Nutrition: Macro (Carbohydrates, proteins, lipids) - and Micronutrients (vitamins), Essential minerals and their role; deficiency symptoms; and their role; deficiency symptoms. Micro organisms: Classification of Microorganisms, beneficial and harmful effects of Bacteria, Fungi and Viruses. Biosensors, biomechanics and Medical Imaging technology, Applications of Biosensor in Food and Agriculture.

Text books:

1. Advanced Biotechnology; Dr RC Dubey; S Chand Publications.
2. Elements of Biotechnology; P K Gupta; RASTOGI Publications.

ENGINEERING CHEMISTRY

Course code: 17 CY 1001 **L-T-P-S: 3-0-2-0**
Pre Requisite: NIL **Credits: 4**

CO No:	COURSE OUT COME	PO	BTL
1	Predict potential complications from combining various chemicals or metals in an engineering setting	2,3	4
2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena	2,3	3
3	Examine water quality and select appropriate purification technique for intended problem	2,3	3
4	Apply polymers, conducting polymers ,green chemistry and nano chemistry to engineering processes	3	3
5	An ability to analyze & generate experimental skills	2,3	4

Syllabus: ELECTRO CHEMISTRY: Single electrode potential and its measurement, Electrochemical cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells, Concentration cells, Reference electrodes--Determination of pH using glass electrode. **Storage devices :** Chemistry, construction and engineering aspects of Primary (mercury battery) and secondary (lead-Acid cell, Ni-Metal hydride cell, Lithium cells) and fuel cells– Hydrogen–Oxygen fuel cell, advantages of fuel cell. , **Fuels –** Types of fuels, Calorific value, Determination of Calorific value; **CORROSION & ITS CONTROL:**Causes and different types of corrosion and effects of corrosion. Theories of corrosion– Chemical, Electrochemical corrosion, Pitting corrosion, stress corrosion, Galvanic corrosion. Factors affecting corrosion– Nature of metal, galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment- effect of temperature, effect of pH, Humidity, effect of oxidant. Cathodic protection, sacrificial anode, impressed current cathode, electroplating; ***METAL ALLOYS:*** Types of Alloys- ferrous and nonferrous alloys, Carbon steel, Alloy steel, Alloys of Cu, Al, Pb.**PHASE RULE:** phase rule applications to one and multiple component systems phase diagram. **WATER Technology**: Introduction, *Hardness:* Causes, expression of hardness – units – types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Alkalinity and estimation of alkalinity

of water, numerical problems. ***Boiler troubles*** – Scale & sludge formation, caustic embrittlement, Boiler corrosion, priming & foaming. ***Softening of water***: Internal and external treatments -Lime soda, Ion exchange process. ***Desalination-***reverse osmosis and electro dialysis. **POLYMERS AND PLASTICS: Basic concepts of polymers-** Types of polymerization-Plastics – Thermoplastic resins and Thermosetting resins - Compounding of plastics – Fabrication of plastics. Preparation, properties and engineering applications of: polyethylene, PVC, Teflon, Bakelite, Urea Formaldehyde. **Conducting Polymers**: Polyacetylene,polyaniline, conduction, doping and applications. **Polymer composites:** Physico Chemical properties of polymer composites and Applications.**NANO TECHNOLOGY:** Introduction, Fullerenes, Carbon nanotubes, Nanowires; properties; Synthesis of nanomaterials; Topdown & bottom up approach; Applications of nanomaterials.**GREEN CHEMISTRY: Introduction,** Green technology- Latest green laboratory technology for saving experimental resources and infrastructural framework; R4M4 (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking, Multi-tracking;) model with special reference of survismeter, econoburette.

Text books:

1. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Company. New Delhi.
2. Engineering Chemistry, O G Palanna, The Tata McGraw Hill, New Delhi.

Reference Books:

1. Chemistry in Engineering and Technology, Volume 2, J C Kuriacose & J Rajaram, Tata McGraw Hill, New Delhi.
2. Chemistry for Engineers,Dr Rajesh Agnihotri, Wiley, New Delhi.
3. Engineering Chemistry, B. Sivasankar, The Tata McGraw Hill, New Delhi.
4. A text book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co. New Delhi.
5. Engineering Chemistry, C Parameswara Murthy, C V Agarwal and Andra Naidu, B S Publications, Hyderabad.
6. Engineering Chemistry, Shikha Agarwal, Cambridge University Press.

SINGLE VARIABLE CALCULUS AND MATRIX ALGEBRA

Course Code: 17MT1101 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	COURSE OUT COME	PO	BTL
1	Model the physical laws and relations mathematically as a first order differential equations, solve by analytical and numerical methods also interpret the solution.	**1**	**2**
2	Model physical laws and relations mathematically as a second/higher order differential equations, solve by analytical method and interpret the solution.	**2**	**2**
3	Obtain the Fourier series expansions of periodic functions and use the series to solve ordinary differential equations.	**1**	**2**

4	Model physical problems mathematically as a system of linear equations and solve them by analytical and numerical methods. Also, determine the nature of Quadratic form using Eigen values.	**1,2**	**1**

SYLLABUS:

Differential Equations: Definitions and terminology and mathematical models used in differential equations. First-order and higher-order differential equations, along with the methods of solutions and their applications. Modeling with first and higher-order also systems of linear first-order differential equations. Solutions of first order ordinary differential equations by Numerical methods.

Fourier series: Definitions and Fourier series for a periodic signal. Fourier series for simple functions. Fourier series of the summation of sinusoids directly from the definition by using Euler's formula. Solving particular solution to differential equation by Fourier series.

Matrix algebra: Solving linear System of equations by Gauss-elimination, L U decomposition and Jacobi, Gauss Seidal iteration methods, orthogonal, symmetric, skew-symmetric, Hermitian, Skew-Hermitian and unitary matrices, Eigen values, Eigen vectors and their properties, Cayley -Hamilton theorem (without proof) and its applications, and quadratic forms.

Text books:

1. Advanced Engineering Mathematics, Erwin Kreyszig. John Wiley & Sons, Inc. 10th Edition.
2. Advanced Engineering Mathematics, Greenberg, PHI Publishers, 2nd Edition.

Reference Books:

1. Differential Equations for Engineers, Wei-Chau Xie, Cambridge University Press, New York.
2. Higher Engineering Mathematics, BS Grewal. Publisher: Khanna, New Delhi.
3. Advanced Numerical Methods with MATLAB, SC Chapra, Tata McGraw-Hill.

FOUNDATIONS OF COMPUTATIONAL MATHEMATICS

Course Code: 17MT1102 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	Identify the quantities of Real world problems by using the concepts of arithmetic.	**1**	**2**
2	Computing the areas of regular and irregular solids of real world problems.	**1**	**2**
3	Identifying the numbers by successive division also finding the solution of equations.	**1**	**2**
4	Estimating the roots of an equations and find the unknown values from the data by numerical methods	**11**	**1**

SYLLABUS:

Numbers: Bodmas Rule, Fractions & Decimals, Classification of numbers, Divisibility rules, factorization, Division & Successive division, Remainders in divisions involving higher powers, LCM and HCF and Number systems.

Algebra: Powers, roots and Indices, Venn diagrams, Surds, Logarithms, Quadratic Equations & Inequalities, Progressions, Simple Equations. Transposing formulae and solving simultaneous equations.

Arithmetic: Ratios, Proportion, Variation, Percentages, Profit & Loss, Simple & Compound Interest, Averages, Mixtures and Allegations, Time and Distance, Time and Work, Clocks, Calendars and Blood relations

Geometry and Mensuration: Lines & angles, triangles, quadrilaterals, polygons, circles, surface areas, volumes of 3D figures, graphs reducing non-linear laws to linear form and graphs of exponential functions.

Prescribed Text Books

1. Basic Engineering Mathematics**,** John Bird, Fourth Edition, Elsevier.

Reference Text Books

1. Quantitative Aptitude, R. S. Aggarwal, Schand Publications.
2. Quantitative Aptitude - G. L. Barrons.
3. Quantitative Aptitude - Abhijit Guha, Mc Graw Hills.

MULTIVARIATE CALCULUS

Course Code: 17MT1203 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course Outcome	PO	BTL
1	Determine extreme values for functions of several variables	**1**	**3**
2	Determine area, volume moment of inertia through multiple integrals in Cartesian or polar co-ordinates.	**1**	**3**
3	Apply the concepts of vector calculus to calculate the gradient, directional derivative, arc length, areas of surfaces and volume of solids in practical problems	**1**	**3**
4	Obtain analytical and numerical solutions of Heat and wave equations	**1**	**3**
5	Verify the solution of problems through MATLAB	**1**	**3**

SYLLABUS:

Differential Calculus: Partial derivatives, Jacobian, total differentiation and their applications, chain rule, Taylor's series for function of two variables, maxima and minima of functions of two variables, Lagrange's multipliers method.

Integral Calculus: Line integrals- double and triple integrals and applications to area, volume, mass & moment of inertia. Change of order of integration, change of variables in polar, cylindrical and spherical polar coordinates.

Vector Calculus: Scalar and vector point functions, gradient and directional derivative of a scalar point function, divergence and curl of a vector point function. Line, surface and volume integrals, Green's, Gauss divergence and Stoke's theorems and their applications

Partial differential equations: Formation of partial differential equations, solutions of first order linear and nonlinear PDEs by Lagrange method, solution of second order PDEs by method of separation of variables i.e., one dimensional wave and heat equations, Laplace equation in two dimensions. Solving Laplace equation by Finite difference method.

Text books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th Edition, John Wiley &Sons, Inc, Newyork . (2015)

2. Nakhle H Asmar, Partial differential equations with Fourier series and boundary value problems, Second edition Pearson Pub.

Reference Books:

1. Michael Greenberg, Advanced Engineering Mathematics. Second edition, Prentice Hall, USA.
2. Zafar Ahsan, Differential equations and their applications, second edition, PHI
3. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, India.

LOGIC AND REASONING

Course Code: 17MT1204 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course Outcome (CO)	PO/PSO	BTL
1	Understand how to use Venn diagrams to find the conclusion of statements, solve puzzles using binary logic.	1	**2**
2	Understand to solve problems on clocks, calendars and problems on Non verbal reasoning.	1	**2**
3	Understand the available models for Venn diagrams with given data, solve problems relating to cubes and number and letter series.	3	**2**
4	Understand the techniques used to solve problems puzzles using analytical reasoning on coding and decoding and blood relations	1,3	**2**

SYLLABUS:

Permutation and Combinations: Fundamental Principle of Counting, Counting Methods, Definition of permutation, Linear Permutations, Rank of a word, Circular Permutations, Definition of Combinations, Problems on Combinations

Probability: Definitions of Probability, Addition and Multiplication Theorems.

Deductions: Introduction, expressing different types of statements using Venn diagrams, Definition of complimentary pairs, Finding the conclusions using Venn diagrams for two and more statements. **Logical Connectives:** Definition of simple statement, Definition of compound statement, Finding the implications for compound statements, Finding the negations for compound statements. **Binary Logic:** Definition of a truth-teller, Definition of a liar, Definition of an alternator, solving problems using method of assumptions, solving analytical puzzles using binary logic. **Cubes:** Basics of a cube, Finding the minimum number of cuts when the number of identical pieces are given, Finding the maximum number of pieces when cuts are given, Problems on painted cubes of same and different colors, Problems on cuboids, Problems on painted cuboids, Problems on Dice. **Data Sufficiency:** Different models in Data Sufficiency, Problems on Data sufficiency, Problems on data redundancy.

Data Interpretation: Problems on tabular form, Problems on Line Graphs, Problems on Bar Graphs, Problems on Pie Charts. **Analytical Reasoning puzzles:** Problems on Linear arrangement, Problems on Circular arrangement, Problems on Double line-up, Problems on Selections, Problems on Comparisons. **Number and letter series:** Difference series, Product series, Squares series, Cubes series, Alternate series, Combination series, Miscellaneous series, Place values of letters.

Number and Letter Analogies: Definition of Analogy, Problems on number analogy, Problems on letter analogy, Problems on verbal analogy.

Odd man out: Problems on number Odd man out, Problems on letter Odd man out, Problems on verbal Odd man out.

Coding and decoding: Coding using same set of letters, Coding using different set of letters, Coding into a number Comparison & Elimination

Text Books

1. A modern approach to Logical reasoning, R S Agarwal, S. Chand Publications.

Reference Text Books

1. Logical Reasoning, Arun Sharma, Mc Graw Hill.
2. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications.

ENGINEERING MATERIALS

Course code: 17 PH 1001 **L-T-P-S:** 2-1-2-0

Pre Requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Student outcomes:

CO No:	Course Outcome(CO)	PO	BTL
1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.	1	1
2	Understands magnetic properties of materials and identifies their role in classification soft & hard magnetic materials having specific engineering applications.	1	1
3	Understands thermal and mechanical properties of materials, heat treatment methods for changing the microstructure of materials and responses of materials subjected to load.	1	1
4	Understands the role of electronic energy band structures of solids in governing various electrical and optical properties of materials.	1	1
5	Apply the knowledge on structure and properties of materials while executing experiments and develop inter disciplinary projects.	1	2

Crystallography: Bonding in materials, Space lattice, basis, unit cell, Seven Crystal systems, Bravais lattice system, Reciprocal lattice, Crystal directions, Miller Indices, problems, Diffraction of Crystals, Bragg's Law, XRD, Laue, Rotating Crystal and powder XRD Techniques, Problems.

Crystal Imperfections: Point Defects, Line Defects, Surface Defects, Volume Defects, and Effects of Defects on Crystalline Properties.

Magnetic properties: Origin of Magnetic Moment, Dia, Para, Ferro, Antiferro and Ferri Magnetism, Domain theory and Hysteresis Effect of Ferro and Ferri Magnetism, Soft and Hard Magnetic Materials.

Thermal properties: Iron-Carbon Diagram, Heat capacity, Thermal Expansion and Thermal Conductivity in Metals, Ceramics and Polymers, Heat treatment of Materials, Hardening, Tempering, Quenching and Nitriding.

Mechanical Properties: Stress, Strain, Hooke's Law, Elasticity, Plasticity, Creep, Ductility, Brittle, Hardness, Strength, Modulus of Elasticity, Fracture, Fatigue, Stress- Strain Behavior of Ductile and Brittle Materials, Hardness Tests- Vickers, Rockwell and Brinell.

Electrical Properties: Energy band theory, Band structures in Conductors, Semi conductors and Insulators, Electrical properties of conductors- Ohms, Mathiessen rule, conductivity, Mobility, Electrical properties of Semi conductors, Factors effecting the carrier concentration,

Conductivity and Mobility of charge carriers. Electric properties of Insulator-Dielectrics- Types of Dielectrics, Dielectric Constant, Polarization, Types of Polarizations, Frequency Dependence of Polarization, Ferro, Piezo Electrics.

Optical properties: Optical reflectance, Optical Absorption, snell's law, Total Internal reflection in optical fibers.

Text books:

1. William D. Callister,Jr. "Materials Science and Engineering: An Introduction" 6th edition, 2007, Wiley India Pvt.Ltd.
2. Charles Kittel, " Introduction to Solid State Physics" 8th edition, 2012, Wiley India Pvt.Ltd.

Reference Books:

1. Adrianus J. Dekker, "*Solid State Physics"* 1st Edition *2002,* Macmillan India Ltd.
2. S. O. Pillai, "Solid state physics" Revised 6th edition, New Age International Publishers.

Rangwala, Engineering Materials (Material Science)**,** Charotar Publishing House PVT. LTD.

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course Code : 17 MT 2009 **L-T-P-S: 2-1-0-0**
Pre-requisite: NIL **Credits: 3**

CO No:	Course Outcome(CO)	PO	BTL
1	Apply the probability and joint and marginal probabilities to suitable real-world situations.	1	3
2	Apply probability distributions to suitable real- world situations and also analyze bivariate data using correlation and regression analysis.	1	3
3	Apply Markov chains and simulation techniques for suitable real world problems.	1	3
4	Apply queuing models for single server with finite and infinite capacity and multi server with infinite capacity to suitable real world problems.	1	3

SYLLABUS

Probability and Random variables: Definitions of probability, Sample space, Axioms of probability, Conditional probability, Addition, Multiplication and Baye's theorem. Random variables, joint and marginal probabilities, Mathematical Expectation.

Standard discrete and continuous distributions: Definitions and simple properties of Binomial, Poisson, Exponential and Normal distributions, Applications of the above distributions.

Correlation and Regression: Correlation coefficient for ungrouped data. Linear and Non-Linear regression.

Stochastic Processes: Discrete-Time Markov Chains, Continuous- Time Markov Chains.

Queuing models: Single and multi-server Markovian queuing models with finite and infinite capacity.

Simulation: Introduction to simulation, simulation examples, general principles, statistical models in simulation. Verification and validation of simulation models.

Text Books

1) Ronald E. Walpole, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson.
2) Kishore S Trivedi, "Probability& Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, Wiley India, 2009.

Reference Books

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, 11th Edition PHI, New Delhi.
2. Jerry Banks, John S Carson, Barry L Nelson, David M Nicol, Discrete- Event System Simulation, 4th Edition, Pearson..
3. Jay L. Devore, Probability and Statistics for Engineers, CENAGE learning.
4. S C Gupta and V K Kapoor , Fundamentals of Mathematical Statistics, 11th Edition, S Chand & Sons, New Delhi,

ENGINEERING SCIENCE COURSES

ENGINEERING MECHANICS

Course Code: 17 ME 1001 **L-T-P-S:** 3-0-2-0
Prerequisite: NIL **Credits:** 4

CO No:	Course Outcome(CO)	PO	BTL
1	Understand the concept of forces and apply the static equilibrium equations.	2	2
2	apply principles of co-planar and non co-planar system of forces	2	2
3	Apply the concept of centroid & centre of gravity to determine moment of inertia.	2	2
4	apply the kinetics and kinematics principles to rigid bodies under translation and rotation	2	2
5	Understand and apply the engineering systems with the help of mechanics concept to solve the engineering problems.	2	2

Syllabus:

Statics: **Two Dimensional Force systems**- Introduction, Basic concepts, Laws of motion, Principle of Transmissibility of forces, Resultant of a force system, force laws, Resultant of two dimensional concurrent and Non-concurrent Force systems, Free body diagrams, Applications. **Equilibrium of Rigid bodies–**Equilibrium and Equations of Equilibrium, Lame's theorem,Type of supports and their reactions**,** Moments and couples, Varignon's theorem, Resultant moment and applications.

Spatial Force Systems and Trusses : **Spatial force systems** – Forces in space, resultant and equilibrium of spatial force system. **Truss Analysis**-Trusses-Assumptions involved in the Method of joints and sections.

Friction And Properties of Areas : **Friction**: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Applications-ladder friction, wedge friction.

Centriod and Moment of Inertia: Centroids, centre of gravity, Moment of inertia- Area and Mass- polar moment of inertia, Parallel axis theorem.

Dynamics : **Kinematics of Rigid Body:** Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational motion.**Kinetics of Rigid Body:**

Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium.

List of Experiments

1. Calculation of Moment of Force using weight balancing technique.
2. Determination of angle of deflection due to eccentric loading on T bar
3. Determination of Centroid for Plane laminas of straight edges
4. Determination of Centroid for Plane laminas of curved edges
5. Determination of axial forces in Trapezoidal Truss
6. Determination of axial forces in Triangular Truss
7. Understanding vectors and vector quantities
8. Calculation of Moment of Force using weight balancing technique and system of pulleys.
9. Verification of Lamie's Theorem
10. Determination of coefficient of static friction between two surfaces.
11. Determination of motion parameters using work-energy principle
12. Determination of moment of inertia of a flywheel.

Text Books:

1. Engineering Mechanics (in SI Units) / S. Timoshenko, D. H. Young, J.V. Rao/ Tata McGraw Hill.

References:

1. Engineering Mechanics / S. S. Bhavikatti/ New Age.
2. Vector Mechanics for Engineers -Statics &Dynamics / F.P. Beer and E.R. Johnston/ Tata McGraw Hill.
3. Engineering Mechanics-Statics and Dynamics by R. C. Hibbler, Prentice.

Engineering Mechanics- NH Dubey/ New Age

OBJECT ORIENTED PROGRAMMING

Course code: 17CS2004 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	The student will be able to understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language.	**1,2**	**2**
2	The student will be able to apply constructors, Overloading, parameter passing, in Java programming.	**1,2**	**2**
3	The student will be able to apply access control, Inheritance, Packages.	**1,2**	**2**
4	The student will be able to apply , Interfaces, Exception Handling	**1,2**	**2**
5	Students will be able to apply object oriented programming concepts to write programs.	**1,2**	**2**

Introduction: Object-Oriented Programming, OOP Principles, Encapsulation, Inheritance and Polymorphism Java as a OOPs & Internet Enabled language, The Byte code, Data types, Variables, Dynamic initialization, scope and life time of variables, Arrays, Operators, Control

statements, Type Conversion and Casting, Compiling and running of simple Java program. **Classes and Objects:** Concepts of classes and objects, Declaring objects, Assigning Object Reference Variables, Methods, Constructors, Access Control, Garbage Collection, Usage of static with data and methods, usage of final with data, Overloading methods and constructors, parameter passing - call by value, recursion, Nested classes. **Inheritance:** Inheritance Basics, member access rules, Usage of super key word, forms of inheritance, Method Overriding, Abstract classes, Dynamic method dispatch, Using final with inheritance, The Object class. **Packages and Interfaces:** Packages, Classpath, Importing packages, differences between classes and interfaces, Implementing & Applying interface. **Exception Handling:** Exception Handling fundamentals.

Text Books:

1. Herbert Schildt, "The Complete Reference Java", 7th edition TMH.
2. Timothy A. Budd, "An Introduction to Object-Oriented Programming", 3/e, Pearson, 2008.

Reference Books:

1. Deitel & Deitel, "'Java – How to program", 6th edition, PHI, 2007

2. Cay.S.Horstmann and Gary Cornell "Core Java 2, Vol 1, Fundamentals", Seventh Edition, Pearson Education.

DATA STRUCTURES

Course Code: 17CS1102 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms.	**1,2**	**2**
2	Analyse and compare stack ADT and queue ADT implementations using linked list and applications.	**1,4**	**2**
3	Analyse the linked implementation of Binary, Balanced Trees and different Hashing techniques.	**2,4**	**2**
4	Analyse different representations, traversals, applications of Graphs and Heap organization.	**1,2**	**2**

Syllabus: Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations, Lists**. Stacks and Queues:** Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT. **Trees:** Preliminaries, Binary Trees, The Search Tree ADT—Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees, Red black trees. **Hashing:** General Idea, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing. **Priority Queues (Heaps):** Model, Simple Implementations, Binary Heap, Applications of Priority Queues. **Sorting:** Preliminaries, Insertion Sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting. **Graph Algorithms:** Definitions, Topological Sort, Shortest-Path Algorithms, Minimum Spanning Tree.

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2010 , Second Edition, Pearson Education.
2. Ellis Horowitz, Fundamentals of Data Structures in C: Second Edition, 2015

Reference Books:

1. A.V.Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures And Algorithms", Pearson Education, First Edition Reprint 2003.
2. Horowitz, Sahni, Anderson Freed, "Fundamentals of datastructures in C" , Second Edition-2007.
3. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Ed ition, 2005
4. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, "Data Structures & Program Design in C", Fourth Edition-2007.

WORKSHOP PRACTICE

Course Code: 17ME1003 **L-T-P-S: 0-0-2-0**

Pre Requisite: NIL **Credits: 1**

Common Experiments for ALL Branches:

CARPENTRY - Hands on practice on wood working operation using hand tools to prepare Lap T joint and plus joint.
FITTING - Hands on practice on preparing square fit and L fits.
TIN SMITHY - Hands on practice on sheet metal working for preparing cylindrical pipe and rectangular tray / Pipe T joint.
HOUSE WIRING - Hands on practice on electrical house stair-case and godown connections
WELDING - Hands on practice joining of metal plates using arc welding equipment
CASTING – Hands on practice on Gravity die casting for preparation of wax pipe flange / dumb bell.
MACHINE SHOP – Hands on practice on Lathe, Drilling machine tools

TEXT BOOKS:

1. P.Kannaiah and K. L. Narayana, Engineering Practices Laboratory, 2009, SciTech Publications, Chennai

REFERENCE BOOKS:

1. KLEF workshop lab manual
2. K. Venkata Reddy, "Workshop Practice Manual", Sixth edition, 2011 print, BS Publications, Hyderabad.
3. B S Nagendra Parashar and R K Mittal, "Elements of Manufacturing Process", 2010 print, Prentice Hall of India, New Delhi

PROBLEM SOLVING & COMPUTER PROGRAMMING

Course Code: 17CS1101 **L-T-P-S: 2-2-2-0**

Pre-requisite: NIL **Credits: 5**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	Illustrate how problems are solved using computers and programming.	**1, 2**	**1**
2	Illustrate and use Control Flow Statements in C.	**1,2**	**1**

3	Interpret & Illustrate user defined C functions and different operations on list of data.	**1,2**	**2**
4	Implement Linear Data Structures and compare them.	**4,12**	**2**

Syllabus: Problem Solving Approach, **Algorithms and Algorithm Analysis**, Program Development Steps, Structure of C Program, Pre-Processor Directives, **Formatted I/O**,**C Tokens, Data Types**: Primitive, Extended and Derived Including Pointers, Operators, Precedence, Associativity , **Redirecting I/O** :Files and File Operations , **Control Flow Statements, Functions, Recursion**, Scope of Variables and Storage classes, **Arrays,** 2-DimensionalArrays,Dynamic Memory Allocation, **Searching:** Linear Search and Binary Search, **Sorting:** Bubble Sort, **Strings**, **Structures and Unions**, Introduction to **Stacks-**Implementation using array, Introduction to Queues – Linear **Queue-**Implementation using array, Introduction to **Lists:** Single Linked List- Insertion, Deletion, Display.

Text Books:

1. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language: ANSI C Version", 2/e, Prentice-Hall/Pearson Education-2005.
2. E. Balagurusamy, **"**Programming in ANSI C" 4th ed.,Tata McGraw-Hill Education, 2008 **.**
3. R. F. Gilberg, B. A. Forouzan, "Data Structures", 2nd Edition, Thomson India Edition-2005.

Reference Books:-

1. Mark Allen weiss, Data Structures and Algorithm Analysis in C, 2008, Third Edition, Pearson Education.
2. Horowitz, Sahni, Anderson Freed, "Fundamentals of Datastructures in C", 2nd Edition-2007.
3. Robert Kruse, C. L. Tondo, Bruce Leung, Shashi Mogalla, "Data structures and Program Design in C", 4th Edition-2007.
4. C for Engineers and Scientists – An Interpretive Approach by Harry H. Cheng, Mc Graw Hill International Edition-2010.
5. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", 7/e, Pearson Education-2004.
6. Jean Paul Trembly Paul G.Sorenson, "An Introduction To Data Structures with applications", 2nd Edition.

ENGINEERING GRAPHICS

Course code: 17ME1002 **L-T-P-S: 1-0-4-0**
Pre Requisite: NIL **Credits: 3**

CO No	Course out come	PO	BTL
1	To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects, Orthographic projections of points, lines and planes	**1**	**2**
2	Draw projection of solids like cylinders, cones, prisms and pyramids including sections. Layout development of solids for	**1**	**2**

	practical situations. Generating the sectional views and Draw simple curves like ellipse, cycloids and developments of surfaces for various geometry		
3	Build orthographic projections, create isometric sketches and identify standard features such as hole, slots, etc…	**1**	**2**
4	Create, annotate, edit and plot drawings using basic AutoCAD commands and features.	**1**	**2**
5	Demonstrate competency with multiple drawing and modification commands in Solid Works.	**1**	**2**

Introduction to Engineering Drawing : Principles of Engineering Graphics and their significance – Drawing Instruments and their Use- Conventions in Drawing – Lettering – Geometric Constructions – Scales: Plain and Vernier scales

Orthographic Projection in First Angle Projection: Principles of Orthographic Projections-conventions- First and Third Angle, Projections of Points and Lines inclined to both planes, True lengths, traces.

Projections of Planes & Solids: Projections of regular planes inclined to both planes . Projections of Regular solids inclined to one plane

Sections and Sectional Views:-Right Regular Solids - Prism, Cylinder, Pyramid, Cone

Isometric Projections: Principles of Isometric Projection- Isometric Scale- Isometric view conventions- Isometric View of Lines, Plane Figures, simple problems

Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions

Dept Specific :Overview of Computer Graphics covering & Customisation & CAD Drawing

Demonstrating knowledge of the theory of CAD software, Drawing Area, Dialog boxes and windows, Shortcut menus, Command Line, Status Bar, Different methods of zoom, erase objects. scale settings, applying dimensions to objects and annotate; use of Layers, Create, edit and use customized layers.

Text Books:

1. Engineering Drawing, N.D.Bhat/ Charotar
2. Engineering Drawing , N.S.Parthasarathy,VelaMurali
3. Machine drawing- N.D.Bhatt., published by R.C. Patel Charotar Book Stall Tulshi Sadan, Station Road, Annad, India
4. Dash.S.S, Subramani.C, Vijayakumar.K, ”Basic Electrical Engineering”, First edition,Vijay Nicole Imprints Pvt.Ltd,2013
5. Printed Circuit Boards, Design, Fabrication, Assembly and testing , Dr.R.S.Khandpur
6. Printed Circuit Board Designer's , Christopher T. Robertson
7. Textbook of Engineering Drawing, K. Venkata Reddy,(Building Drawing)
8. Thermo chemical Conversion of Biomass to Liquid Fuels and Chemicals, Mark Crocker
9. Advances in Biodiesel Production: Processes and Technologies, R Luque, J A Melero

REFERENCE BOOKS:

- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
- (Corresponding set of) CAD Software Theory and User Manuals
- Machine Drawing by / Bhattacharyya / Oxford
- Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson
- Electrical and Electronics Drawing, C.J. Baer
- Printed Circuit Boards: Design and Technology , By Bosshart
- Basic Biotechnology, edited by Colin Ratledge, Bjorn Kristiansen

BASIC ENGINEERING MEASUREMENTS

Course code: 17 GN 1003 **L-T-P-S:** 2-0-2-0
Pre Requisite: NIL **Credits:** 3

CO No	Course out come	PO	BTL
1	Understand and apply the Basic fundamentals of a measurement system.	**1**	**1**
2	Understand various Mechanical measuring parameters, and apply different measuring techniques on various mechanical parameters using simulation and experimentation tools.	**1**	**2**
3	Understand various Electrical measuring parameters, and apply different measuring techniques on various Electrical parameters using simulation and experimentation tools.	**1**	**1**
4	Understand various Electronic measuring parameters, and apply different measuring techniques on various Electronic parameters using simulation and experimentation tools.	**1**	**1**
5	Apply the theoretical concepts to measure different parameters.	**1,3**	**3**

SYLLABUS:

Basic Fundamental Measuring Units: Definition and representation of Displacement(Linear/Angular), Time, Temperature. Speed, Humidity. **Measurement of Mechanical parameters:** Force, Stress, Strain, Pressure, Velocity, Acceleration, Mass and Weight. **Measurement of Electrical parameters:** Current, Voltage, Power, Energy, Power factor, Resistance, Inductance, Capacitance. **Measurement of Electronic parameters:** Oscilloscope : Amplitude, Frequency, Time period, Phase.

LIST OF EXPERIMENTS:

1. Measurement of Linear displacement using LVDT.
2. Measurement of Strain using Strain Gauge Bridge.
3. Measurement of Voltage using MyDAQ.
4. Measurement of Current using MyDAQ.
5. Measurement of Signal parameters (Amplitude, Time period and Frequency) using DSO.

6. Measurement of Unknown resistance using Wheatstone bridge.
7. Measurement of 1 phase Power, Energy of a R-L load.
8. Measurements of Inductance using Anderson Bridge.
9. Measurement of capacitance using Schering's Bridge
10. Measurement of Angular Displacement using Potentiometer.
11. Calibration of Pressure gauge using Dead Weight Pressure Tester.
12. Characterization of Temperature Sensor (RTD,TC,Thermistor).

Text books & References:

1. Experimental methods for engineers, JP Holman, McGraw Hill Ltd.
2. Mechanical measurements, 6/E, Thomas G Beckwith, Pearson
3. Electrical measurements, Martin U Reissland, New Age Int.

A course in Electrical, Electronic Measurement, AK Sawhney , Dhanpat Rai & Co

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Coding Skills for Engineers

Course code: 17 GN 1204 **L-T-P-S: 0**-0-10-0
Pre Requisite: NIL **Credits:** 5

CO No	Course out come	PO	BTL
1	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms	**1**	**4**
2	Analyze and compare stack ADT and queue ADT implementations using linked list and applications.	**2**	**4**
3	Analyze the linked implementation of Binary, Balanced Trees and different Hashing techniques.	**1**	**4**
4	Analyze different representations, traversals, applications of Graphs and Heap organization.	**2**	**4**
	Develop and Evaluate common practical applications for linear and non linear data structures	**1**	**5**

SYLLABUS:

Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations, Lists. Stacks and Queues: Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT. Trees: Preliminaries, Binary Trees, The Search Tree ADT— Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees, Red black trees. Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing. Priority Queues (Heaps): Model, Simple Implementations, Binary Heap, Applications of Priority Queues. Sorting: Preliminaries, Insertion Sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting. Graph Algorithms: Definitions, Topological Sort, Shortest Path Algorithms, Minimum Spanning Tree.

Text Books :Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2010 , Second Edition, PearsonEducation.
2. Ellis Horowitz, Fundamentals of Data Structures in C: Second Edition, 2015

Reference Books :

1. A.V.Aho, J. E. Hopcroft, and J. D. Ullman, ―Data Structures And Algorithms‖, Pearson Education, First Edition Reprint2003.
2. Horowitz, Sahni, Anderson Freed, ―Fundamentals of datastructures in C‖ , Second Edition-2007.
3. R. F. Gilberg, B. A. Forouzan, ―Data Structures‖, Second Edition, Thomson India Ed ition, 2005
4. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, ―Data Structures & Program Design in C‖, FourthEdition-2007.

Web Links :
1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106101060/4
3. https://www.edx.org/course/algorithms-and-data-structures-1
4. https://in.udacity.com/course/intro-to-algorithms--cs215
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046jintroduction-to-algorithms-sma-5503-fall-2005/video-lectures/lecture-10-red-blacktrees-rotations-insertions-deletions/lec10.pdf

Discrete Mathematics

Course code: 17 CS 2103 **L-T-P-S:** 2-1-0-0
Pre Requisite: NIL **Credits:** 3

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving	**1, 2**	**2**
2	Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.	**1,2**	**2**
3	Be able to use effectively algebraic techniques to analyze basic discrete structures and algorithms.	**1,2,4**	**2**
4	Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples	**2,5,6**	**2**

Syllabus: Sets and Sequences: Data Models. Finite Sets, Power Set, Cardinality of finite sets, Cartesian product, Properties of Sets, Vector Implementations of Sets, Cardinality of Sets, Matrices Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contra positive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example. Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized, Permutations and Combinations, Generating Permutations and Combinations, Binomial

Coefficients and Identities. Advanced Counting Techniques: Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion–Exclusion, and Applications of Inclusion–Exclusion. Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, Lattices. Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Text Books:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications" Seventh Edition Mc GrawHill Publications, ISBN 978-0-07-338309-5

2. SEYMOUR LIPSCHUTZ, MARC LARS LIPSON, Schaum's Outline of Theory and Problems of DISCRETE MATHEMATICS, Revised Third Edition.

Reference Books:

1. Kenneth H. Rosen, ―Discrete Mathematics and its Applications‖, Special Indian Edition,7th Edition, Tata Mcgraw-Hill Publisher, New Delhi.

2. C.L.Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.

3. J .L.Mott, A.Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.

Electrical Circuit Theory

Course code: 17 EE2105 **L-T-P-S: 3-1-0-0**
Pre Requisite: NIL **Credits: 4**
Mapping of Course Outcomes (CO) to Student outcomes:

CO No	Course out come	PO	BTL
1	Understand the circuit elements and AC fundamentals for electrical networks	**1, 5**	**2**
2	Apply Network theorems to Electrical networks (AC & DC)	**1,5**	**2**
3	Analyse the Two port networks, Resonance & Transients	**1,5**	**2**

4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction	**1,5**	**2**

Syllabus:

Introduction to Electrical Circuits: Network elements and their classification. Ohm's law, Kirchhoff's law, Series and parallel combinations of R, L and C. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, star & delta transformation. Mesh and Nodal analysis. Simple problems solving with resistances, dependent and independent sources

AC Circuits: Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor - problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, Mathematical representation of sinusoidal quantities.Steady State Analysis of A.C Circuits: Response to sinusoidal excitation to Series and parallel RL, RC, RLC circuits. Concept of impedance and phase angle.

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's and Compensation theorems. Problem solving with resistances and independent sources. Max. Power Transfer theorem with complex load

Resonance: Series and parallel resonance. Quality factor and bandwidth

Transient analysis (DC Excitation): Series and Parallel RL and RC circuits. Simple problems.

Two port network parameters: Z, Y, ABCD, H and G parameters

Magnetic Circuits: Self & Mutual inductances, dot convention, Impedance transformation and coupled circuits. Faradays laws of electromagnetic induction: elementary treatment on rotary machines w.r.t EMF equation (Statically induced and dynamically induced EMF) and torque production, numerical problems.

TEXT BOOKS:

1. John Bird, Electrical Circuit Theory and Technology, Sixth edition, Newnes (Elsevier) publications, 2017.

2. Jacob Millman, Christor. C W. H. Hayt, J.E. Kimmerly, "Engineering circuit analysis", 8th Edition, Tata Mc-Graw Hill, 2014.

3. J. W. Nilsson and S. Riedel Electric Circuits, 9/E Pearson-Prentice Hall, 2011:

4. Electric machinery by P S Bimbhra, Khanna Publishers, 7th Edition, 2011

REFERENCE BOOKS:

1. Electric Circuits – J. Edminister and M.Nahvi – Schaum's Outlines,

2. Network Analysis by ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.

3. Ashfaq Husain, "Electric Machines", 2nd Edition, Dhanpat Rai& Co, 2014.

INTRODUCTION TO ELECTRONICS ENGINEERING

Course code: 17 EC 1101 **L-T-P-S: 2-0-2-0**
Pre Requisite: NIL **Credits: 3**
Mapping of Course Outcomes (CO) to Student outcomes:

CO No:	CO	PO / PSO	BT L
1	Discuss the various applications of electronics in everyday lives and Introduction to basic components.	1,2,5	2
2	Understand various types of Displays and Sensors and usage in everyday life.	2	2
3	Understand the usage of diodes, motors and Regulators in design of electronic applications.	1,2,5	2
4	Understand the Process, Interfacing and Parameters to be considered in design of Electronic Applications	1,5	2
5	Implement the Basic Components, Sensors and Communication Modules using Arduino	1,5	2

Syllabus: Day-to-day usage of electronics. Basic components, Capacitor & types: ceramic, electrolytic, film. Inductor & types: air, iron, tapped. Resistor & types: carbon, ceramic, wire wound, LDR. Carbon resistor color code, RF inductor color code. Thermistor vs Sensistor. Switch & types. Diodes: switching, signal, photodiode, LED.
LED types: visible, IR. Common anode & cathode, patterns with LEDs, interfacing with LEDs, usage in daily life. Relay & types: EMR, SSR, usage in daily life. LCDs, usage in daily life. Temperature sensor & calibration, Microphone as a sensor. Gas sensor, calibration & response. LDR & its usage in daily life. LDR as a sensor. IR & photodiode as a sensor pair, usage in daily life. Motor & types: DC, servo, stepper. Necessity of driver. Duty cycle. Controlling using PWM & driver, usage in daily life. Regulators & calibrations. Heat sink with regulators.
Sinking & sourcing. Interfacing different devices & considerations. Design sequence: requirement, visualizing, layout, datasheets, simulation, corner cases, short circuit testing, finalizing specifications. Crucial parameters: Ratings, power consumption, processing delay, dissipation, lasting, cost, replacement.

PROFESSIONAL CORE COURSES

ANALOG ELECTRONIC CIRCUIT DESIGN

Course Code: 17EC2101 **L–T–P–S: 3-0-4-0**
Pre-requisite: NIL **Credits: 5**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Analysing various diode-based circuits	1,2	3
CO2	Demonstrating working principles of BJT and JFET, Design of BJT amplifier, feedback amplifiers	1,2	3
CO3	Demonstrating the Linear & Non-linear applications of OPAMPs, filters	1,2	2
CO4	Design of the concepts of oscillators	2,4	2
CO5	Design and Testing of Analog circuits	4	3

Diodes: Concepts of diode as a switching element, diode as Limiter, design of: Clipper, half wave & full wave rectifier, Clamper, Voltage multiplier, Capacitor filters, Concepts of Regulators: Series and shunt voltage regulator, Zener diode, Design of Zener diode regulator, Concept of junction capacitance, Varactor diode, LED.

Transistors: Concepts of amplifier, Q point, load line analysis, Biasing of BJT, Self-Bias-CE, High and low frequency –small signal models of Transistors, Expression of voltage gain, current gain, input & output impedance, Designing CE amplifier, FET fundamentals, Configurations, current-voltage characteristics, Biasing of JFET, Biasing of MOSFET FET small signal model, Design and analysis of RC coupled amplifier, Concept of Feedback, Feedback amplifier configurations, Emitter follower.

Op-amps: Ideal OPAMP, Concept of differential amplifier, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower, Adder, Design and analysis of Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier. Filter Circuits: Design and Analysis of Low pass, High pass, Bandpass, Band reject filters

Design and analysis of Oscillators: Barkhausen criterion, Colpitt, Hartley's, RC Phase shift, Wien bridge, & Crystal oscillators.

555 applications: Design and analysis of Monostable & Astable multi vibrators using 555 and their applications.

Textbooks:

1. Muhammad H. Rashid, "Microelectronic Circuit Analysis and Design", Oxford Press.
2. Sedra& Smith, "Micro-Electronic Circuits theory and applications" 2nd edition, Cengage Learning.

Reference Books:

1. JacobMillman& Christos C. Halkias, "Integrated Electronics", Tata -McGraw Hill, 2nd Edition,(2010).
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI. 9th Edition.

LIST OF EXPERIMENTS

1. Zener diode characteristics.
2. Full Wave Rectifier without and with Filter.
3. CE Amplifier.
4. BJT-JFET Amplifier.
5. Op-Amp as Integrator and Differentiator.

6. Design of first order & second order LPF.
7. Design of first order BPF & BSF.
8. Triangular/rectangular wave generator.
9. Monostable and Astable multivibrator using 555 timer.
10. RC Oscillators.
11. LC Oscillators.
12. Complementary Class-B Push Pull Amplifier.

DIGITAL SYSTEM DESIGN

Course Code: 17EC2102 **L–T–P-S : 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Understand the circuit elements and AC fundamentals for electrical networks	1,3	3
CO2	Apply Network theorems to Electrical networks (AC & DC)	1,3	3
CO3	Analyse the Two port networks, Resonance & Transients	1,3	3
CO4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction	3,4	3
CO5	Design and development of application oriented lab based experiments	4	2

Logic Simplification and Combinational Logic Design: Number Systems, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Karnaugh maps, Binary codes, Code Conversion, Integrated Circuit Logic Gates.

Combinational Logic Functions: Adder and Substractor, Decoders, Encoders, Multiplexers, Demultiplexers, Magnitude Comparators, Parity Generators and Checkers, BCD to seven segment decoders. Verilog HDL design for Combinational Logic Functions.

Sequential Logic Functions: NAND/NOR Latches Gated Latches, Edge- Triggered Flip-flops. Registers and Counters: Shift register, Universal Shift Register, Design of Synchronous and Asynchronous Counters, Modulus counters.Mealy and Moore machines, State diagrams and Tables, FSM, Introduction to ASM charts. Verilog HDL design for Sequential Logic Functions.

Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Logic implementation using Programmable Devices. Complex Programmable Logic Devices, Field Programmable Gate Arrays, Applications of CPLDs and FPGAs.

Text Books:

1. Stephen Brown and ZvonkoVrane "Fundamentals of Digital Logic with Verilog Design" Second Edition, McGraw-Hill.
2. M. Morris Mano, "Digital Logic and Computer Design", Pearson

Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009
2. J. Bhasker, "Verilog HDL Synthesis, A Practical Primer", Star Galaxy Publishing.

LIST OF EXPERIMENTS

1. LED Control Using Universal Gates.

2. Combinational Circuit Based Car Security System.
3. Design of Magnitude comparator.
4. Participant selection in Competitions Using Multiplexer.
5. Digital Display of Department Name.
6. Design of Two-digit display using IC7490.
7. Random Number Generator for Gaming Using D-Flip- flop.
8. Ring and Johnson counter.
9. Design of Ripple counter using J-K Flip-Flop.
10. Design of Automobile garage control system using counters.
11. Digital Unlocking System using Shift Register.
12. Digital Data Storage Using Semiconductor Memories.

SIGNALS AND SYSTEMS

Course Code: 17EC2103 **L–T–P-S : 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Understand the representation, manipulation and operations of Continuous-Time and Discrete Time signals and systems.	1	2
CO2	Explore the Continuous-Time signals in Fourier domain and illustration of sampling theorem.	2,3	2
CO3	Understand the Laplace Transforms and application to LTI systems.	3,4	2
CO4	Analyze Discrete Time signals in in Fourier and Z-Transform domain. Apply and evaluate signals and systems concepts to various applications under transform domain.	3,4	3
CO5	Design and verification of signal processing concepts through simulation software.	4	2

Introduction: Basic Continuous Time signals. Classification of signals. Basic elementary signals; sinusoidal and exponential signals, Singularity functions: Introduction to Systems: Classification of systems, Linear time invariant (LTI) system, impulse response, Convolution and interconnections of LTI systems.

Fourier Analysis of Continuous Time Signals: Fourier Transform: Deriving Fourier transform from Fourier series, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Inverse FT, Correlation of Signals. **Hilbert Transform** and their relationship with FT.

Laplace Transforms: Introduction to LT. Analysis and synthesis equations, LT of standard signals, Concept of region of convergence (ROC) for LT, Constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T., Inverse LT, Partial fraction expansion method. Analysis of LTI systems using LT.

Sampling and Reconstruction: Sampling theorem-Graphical and analytical proof for band limited signals, Band pass sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.

Z-Transform: Concept of Z. Transform and its ROC (region of convergence) Inverse Z-Transform, properties of Z-Transforms.

DTFT: Analysis and synthesis equations, DTFT of standard sequences, magnitude and phase spectrum, Properties of DTFT.

Text Books :

1. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
2. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition
3. Discrete Time Signal Processing by A. V. Oppenheim and Shafer
4. Signals, Systems, and Transforms, Phillips, Parr and Riskin, Fourth Edition, Pearson Education, 2008.

Reference Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems – K R Rajeswari
3. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
4. Vinay. Ingle, John G Proakis, "Digital Signal Processing Using Matlab", Pearson

LIST OF EXPERIMENTS

1. Characteristics of sinusoidal signals.
2. Generation and plots of Elementary C.T signals.
3. Interacting with real time signals.
4. Manipulation/operation of continuous time signals.
5. Linear convolution.
6. Fourier series representation of continuous time periodic signals.
7. Fourier transform of continuous time aperiodic signals.
8. Sampling and Reconstruction of signals.
9. Laplace transform of continuous time signals.
10. Frequency response of LTI systems.
11. Z-transform and inverse Z-transform.
12. Discrete time sequences: Frequency domain representation (DTFT).

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code : 17EC2204 **L–T–P-S : 3-0-0-0**
Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Understand the circuit elements and AC fundamentals for electrical networks	1,2	2
CO2	Apply Network theorems to Electrical networks (AC & DC)	1,2	2
CO3	Analyse the Two port networks, Resonance & Transients	1,2	2
CO4	Understand the Magnetic circuits and fundamental laws of electromagnetic induction	2,4	2

Computer system and its sub modules: Number System and Representation of information, Arithmetic and Logical operation and hardware implementation of Arithmetic and Logic Unit, Introduction to memory Unit, control unit and Instruction Set. Working with an ALU, Concepts of Machine level programming, Assembly level programming and High-level programming. Various addressing modes and designing of an Instruction set. Concepts of subroutine and subroutine call, use of stack for handling subroutine call and return.

CPU Design: Introduction to CPU design, Instruction interpretation and execution, Micro-operation and their RTL specification. Hardwired control CPU design. Micro programmed control CPU design. Concepts of semiconductor memory, CPU-memory interaction, organization of memory modules. Cache memory and related mapping and replacement policies. Virtual memory.

Input / Output Devices: Introduction to input/output processing, working with video display unit and keyboard and routine to control them. Program controlled I/O transfer. Interrupt controlled I/O transfer, DMA controller. Secondary storage and type of storage devices. Introduction to buses and connecting I/O devices to CPU and memory.

Pipelining: Introduction to RISC and CISC paradigm. Design issues of a RISC processor and example of an existing RISC processor. Introduction to pipelining and pipeline hazards, design issues of pipeline architecture. Instruction level parallelism and advanced issues.

Text Books:

1. William Stallings, Computer Organization and Architecture: Designing for Performance, 8/e, Pearson Education India. 2010.
2. D. A. Patterson and J. L. Hennessy, Computer Organization and Design, 4/e, Morgan Kaufmann, 2008.

Reference Books:

1. S. Tanenbaum, Structured Computer Organization, 5/e, Prentice Hall of India, 2009.
2. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, Computer Organization, 5/e, McGraw Hill, 2002.

LIST OF EXPERIMENTS

1. Design and Implementation of Binary to 7-Segment Code Converter.
2. Design and Implementation of Binary to BCD Code Converter.
3. Design of Carry-Look-Ahead Adder.
4. Design of Arithmetic Unit.
5. Design of Logical Unit and Computational Processing System for ALU Operations.
6. Implementation of Information Transmission System.
7. Development of Instruction Processing System from Fetching to Execution.
8. Design of 4-bit Universal shift register using D-FF.
9. Implementation of Cache Memory.
10. Choice Based Control of Vending Machine.
11. Peripheral to Peripheral Data Transfer Using DMA.
12. Implementation of 3-Stage Pipelining.

DIGITAL SIGNAL PROCESSING

Course Code : 17EC2205 **L–T–P–S : 2-1-2-0**
Pre-requisite: 17EC2103 **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Understand the Analysis of LTI Systems and Filters	1,2	2
CO2	Explore and Design the Digital filters: Digital IIR and FIR Filter	3	2
CO3	Explain the Realization of FIR filters and Systems	2,4	2
CO4	Analyze DFT and FFT	3,4	4
CO5	Understand the Analysis of LTI Systems and Filters	1,5	3

Analysis of LTI Systems: Discrete Time systems. Convolution; Time domain analysis of LTI systems. System Function, Impulse Response, Causality and Stability of LTI systems. **Applications of Transforms:** Solutions of Linear Constant Coefficient Difference Equations. **Fourier Transformation of Discrete Time Sequences, Discrete Fourier Transform:** Introduction to DFT, Properties of DFT, Circular convolution, Linear convolution using DFT. **FFT**: Introduction to FFT - Radix-2 DIT and DIF FFT Algorithms, Inverse FFT using direct FFT.

Design and Realization of Digital Filters: Digital IIR Filter Design: Introduction, Normalized Butterworth functions. Design of Digital filters using Bilinear Transformation, Impulse invariance and Step Invariance.

Design and Realization of Digital FIR Filters: Characteristics of Linear Phase FIR filters, frequency Response, Designing FIR filters using Windowing Methods.

Realization of IIR Systems: Direct form, Cascade and Parallel form structures**. Realization of FIR systems:** Realization of Direct Form, Transposed Direct Form, Direct form for Linear-Phase FIR systems and Cascade Form structures

Time-Frequency analysis **, Concept of Wavelets and its applications. Applications of DSP.**

Text Books:

1. John G Proakis, Dimtris G Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Education.
2. Alan V Oppenherim, Ronald W Schafer, John R Back, Discrete Time Signal Processing, Pearson Education, 2nd Edition.

Reference Books:

1. Gonzalez Rafael C. and Richard E. Woods, "Digital Image Processing" Second Edition, Prentice-Hall, 2002.

LIST OF EXPERIMENTS

1.Generation of DT sequences and Manipulation on DT sequences.

2. Frequency domain representation of DT sequences: DFT and FFT.

3. Design and Implementation of Digital IIR Filters.

4. Design and Implementation of Digital FIR Filters.

5. Spectral effects of Decimation of discrete sequences.

6. Spectral effects of Interpolation of discrete sequences.

7. Design the analysis/synthesis of two-channel orthogonal filter bank with filter length is N = 32, and the lowpass passband edge frequency $\omega p = 0.43\pi$.

8. Signal Feature Extraction using Wavelet transform.

9. Automatically Insert a watermark on an Image.

10.Measure similarity between two voice signals.

11. Image Edge Feature Extraction Using Masks.

12. Image Feature Extraction using Wavelet transform.

ANALOG AND DIGITAL COMMUNICATION

Course Code: 17EC2206 **L-T-P-S: 2-1-2-0**

Pre-requisite: 17EC2101, 17EC2102 **Credits: 4**

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	have a good understanding of both time and frequency domain representations of signals;	1,2	2
CO2	have a good understanding of analog modulation and demodulation techniques;	1,2	2
CO3	have a good understanding of digital modulation and demodulation techniques; Understanding pulse modulation systems	1,2	2
CO4	Understand and be able to implement noise and Error analysis of an analogue system.	2,4	2
CO5	Experimentation and design of communication circuits through project based labs.	4	3

Analog Modulation Systems: Need for Modulation, Frequency Translation methods.
Linear Modulation techniques: AM, DSB-SC, SSB and VSB modulation techniques. Demodulators: Synchronous, and envelope detectors. AM systems in the presence of noise.
Angle Modulation: Phase and Frequency Modulation techniques. Narrow Band FM and Wide Band FM, Carson's Rule, Indirect and direct methods of Frequency Modulation. FM systems in the presence of noise. Pre-emphasis and De-emphasis, FM demodulation using PLL, Noise considerations in AM and FM. Transmitters and Receivers, PAM, PWM and PPM
Digital Modulation Systems: Pulse Modulation: Baseband signals. Sampling process; Quantization Process; Quantization Noise; Pulse-Code Modulation; Noise Considerations in PCM Systems(T1/E1); line coders, DPCM, DM, ADM, Matched filter receivers, Shift keying schemes (ASK, PSK, FSK), QAM, MSK, QPSK bandwidth consideration and probability of error calculations for these schemes.

Text Books:

1. Lathi, "Modern Digital & Analog Communications Systems", 2e,Oxford University Press
2. Simon Haykin and Michael Moher, "An Introduction to Analog & Digital Communications",2nd Ed., Wiley, (2007).
3. Analog & Digital Communication by Sanjay Sharma.
4. Wayne Tomasi, "Advanced Electronic Communication Systems", 5th Edition, Pearson Education, 2009.

Reference Books:

1. H Taub & D. Schilling, Gautam Sahe, "Principles of Communication Systems", TMH, 3rd Edition, (2007).
2. Bruce Carlson, Paul B. Crilly and Janet C. Rutledge, "Communication Systems:
3. An Introductionto Signals and Noise in Electrical Communications", 4th Edition, McGraw-Hill, (2002).
4. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, (2001).

LIST OF EXPERIMENTS

1. Amplitude Modulation and Demodulation.
2. DSB-SC Modulation and Demodulation.
3. Frequency Modulation using Xr 2206.
4. FM Demodulation using PLL.

5. Pulse Amplitude Modulation and Demodulation.
6. Pulse Width Modulation and Demodulation.
7. Pulse Position Modulation and Demodulation.
8. Sample and Hold.
9. ASK Modulation and Demodulation.
10. FSK Modulation and Demodulation.
11. BPSK Modulation and Demodulation.
12. ADC and DAC.

COMPUTER NETWORKS

Course Code: 17EC3107 **L-T-P-S: 3-0-2-0**
Pre-requisite: NIL **Credits: 4**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Find basic networking models and functions of physical Layer	2	2
2	Define the functions of Data Link Layer in different networks.	2	2
3	Find the functions of Network layer	2	2
4	To be familiar with the role of transport and application layers	2	2
5	To be able to simulate different networking devices	3	2

Use of Computer Networks, Network Hardware, Network software, Reference models, Example Networks Physical Layer: The theoretical basis for Data Communication, Guided Transmission media, Modems, ADSL, Trunks and Multiplexing.

Switching Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet.

Network Layer: Network layer design issues, Routing algorithms, congestion control algorithms, Quality of service, Internetworking, network layer in the Internet

Transport Layer: Transport service, Elements of transport protocols, Internet transport protocols: TCP&UDP, Performance Issues Application Layer: Domain Name System, Electronic Mail, and World Wide Web.

Text Books

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall, Fifth Edition.2011
2. Behrouz A. Fourouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Third Edition, 2006.

Reference Books

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Pearson
Education, 2012.
2. William Stallings, Data and Computer Communications, 7/e, Pearson Edition, 2007
3. John Goerzon, Tim bower, Brandon Rhodes, foundation of python network programming, 2010, edition 2, publisher: Press

ELECTRONIC SYSTEM DESIGN WORKSHOP

Course Code: 17EC3108 **L–T–P–S: 2-0-4-0**

Pre-requisite: 17EC2101 & 17EC2102 **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Understanding basic concepts of electronics system design and recap of systems learnt so far	1	2
2	Learn how to specify electronic systems and understand their impacts on the performance. Also understand ESD design process	2	3
3	Students will get hand on experience on designing circuits and project of various complexities., analog and digital	3,4	3
4	Understanding the complete process of PCB hart-work design, fabrications and packaging and EMI/MC issues	3,4	4

Electronic Systems and Classifications Micro-electronics technology, Product development process and Life Cycle. Electronic Product design and development Methodology, Designs using Sensors, Isolators, Drivers and Actuators, ADCs and DACs. Electronic systems related to: Automobile, Communication, Industrial, Instrumentation, Mechatronics, Medical and Power Electronics,

Specifications: Electronic systems and Amplifier types -Transient, Distortion, Frequency, DC and small signal specifications, Power dissipation. **Amplifier types:** Linear, Audio RF, Servo. *Interstage coupling issues in RF and* UHF amplifier.

Electronic Systems Design process: Elements of design process (with examples) Design of Electronic Circuits (with examples), Design , assembly and testing of Low , medium and large complexity products and packaging using Analog , Digital, Micon and Electromechanical components.

PCB Fabrication and design: Artwork of PBBs using PC software, Fabrication of Single/double sided PCBs, SMD techniques, EMI/EMC compatibility, High frequency designs, PTH, Multilayer PCB desingns grounding in mixed signal system. EMI/EMC:Designing for (EMC), Cabling and shielding techniques

Text books:

1. Electronic Instrument Design, 1st edition; by: Kim R.Fowler; Publisher: Oxford University Press, 2015.
2. Karl. T. Ulrich, Steven D. Eppinger, " Product design & development", Mc Graw Hill Companier 5th edition
3. Electronic Product Design, R.G.Kaduskar, V.B.Baru, Wiley India 2nd edition

Reference Books:

1. Printed Circuit Boards - Design & Technology, 1st edition; by: Walter Bosshart; Tata McGraw Hill
2. David a. Bell electronic devices and circuits 5th edition.
3. Monograph on Electronic circuit Design: Goyal &Khetan

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROCESSORS AND CONTROLLERS

Course Code: 17EC3109 **L–T–P-S :2-1-2-0**
Pre-requisite: 17EC2102 **Credits: 4**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No:	Course Outcome (CO)	PO	BTL
CO1	Able to understand and analyse the architectural features of CISC type of General purpose processor Intel 8086 Microprocessor.	1,2	2
CO2	Able to understand and analyse the architectural features of CISC type of microcontroller - Intel 8051 Microcontroller.	1,2	2
CO3	Able to understand and analyze the architectural features of RISC type of microcontroller – PIC Microcontroller.	1,2	2
CO4	Able to program 8086 microprocessor, 8051 and PIC microcontrollers in assembly language using TASM, KEIL, MPLAB and Proteus tools.	2,4	2

Microprocessors: Introduction to Microprocessors, Intel Microprocessor families, 8085 & 8086 Microprocessor architectures, 8086 Register Organization, Pin Description, Physical Memory, Organization, Modes of operation. 8086 Instruction set & Assembly Language programming, Addressing modes, Instruction set, Assembler directives, simple Programs, Procedures and Macros, 8086 Interrupts.
8051 Microcontroller: Microcontroller families, 8051 Architecture, Signal Description, Register organization, Internal RAM, Special Function Registers, Interrupt control flow, Timer/Counter Operation, Serial Data Communication, and RS-232C Standard.
8051 Programming & Interfacing: Addressing modes, Instruction set, Simple Programs involving Arithmetic and Logical Instructions, Timers/Counters, Serial Communication & Interrupts. PIC Microcontroller: Introduction, Architectural overview, Memory organization, interrupts and reset, I/O ports, Timers. 8255 and 8251
Interfacing: Matrix Key Board, Stepper Motor, LCD's, DAC & ADC. using 8051 and PIC Microcontroller, Embedded C and Embedded OS

Text Books

1. D.V.Hall "Microprocessor and Interfacing", 2nd Edition Tata McGraw Hill Publishing Company,2006.
2. Mazidi&McKinley "The 8051 Micro controller and Embedded systems: using assembles and C, 2nd edition,2007.

Reference Books:

1. A.K. Ray & K. M Bhurchandi, "Advanced Microprocessors & peripherals", Tata McGraw Hill Publishing Company 2002.
2. Raj Kamal, "Microcontrollers - Architecture, Programming, Interfacing & System Design", 2nd edition, Pearson Education, 2009.

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Electromagnetic Fields & Transmission Lines

Course Code: 17EC2212 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

ELECTROMAGNETIC FIELDS & TRANSMISSION LINES

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	Course out come	PO	BTL
1	Apply the principles of vector calculus to estimate the static Electric field due to different sources and Magnetic field due to various current sources	**1**	**2**
2	Develop the boundary conditions on E ,H fields and extend the concepts of static fields to obtain the governing laws of electromagnetic field. Perceive the propagation of uniform plane wave and its characteristics in different media.	**1,2**	**2**
3	Interpret the characteristics of the guided waves to understand the modes of propagation in wave-guides	**1**	**2**
4	Perceive the energy propagation over transmission lines involving measurement of power and impedance with an insight into appropriate matching techniques.	**1,2**	**2**

Electric and Magnetic Fields: Types of charge distributions, Coulomb's Law, Electric field intensity, electric flux density, Gauss's Law and applications, Divergence, Divergence theorem , Potential and Potential difference, Potential gradient, Poisson's and Laplace's equations. Boundary conditions on E and D, Energy density in Electrostatic field. Electric current, current densities, equation of continuity. Fundamentals of steady magnetic field, Faraday's Law of Induction, Biot - Savart's Law and applications, Ampere's circuital law, differential form of Ampere's circuital law, Curl, Stoke's theorem, Lorentz force equation, force on a current element in magnetic field, Ampere's force law. **Electromagnetic Waves:** Maxwell's Equations in Different Final Forms. Boundary Conditions. wave equation for free space, Uniform plane wave-general solution and propagation. Wave equations for conducting medium. Wave equations in phasor form, wave propagation in loss less medium, conducting medium, good dielectrics and good conductors, skin effect, Poynting theorem and Pointing vector

Guided Waves & Wave Guides : Introduction, Waves between parallel plates, Derivation of field equations between parallel plates and propagation parameters, field components for TE waves, field components of TM waves, Propagation parameters of TE and TM waves, Guided wavelength. Transverse electromagnetic wave. **Transmission lines** : General Solution, infinite line, wavelength, propagation, Reflection Coefficient, Open and short circuited lines, Insertion loss, standing wave ratio, input impedance of open and short circuited lines, power and impedance measurement on lines, Impedance matching–single matching, smith chart and its applications.

Text books:

1.W.H. Hayt Jr , "Engineering Electromagnetic", Mc-Graw Hill – New York, 7th Edition
2.EC.Jordan, "EM waves and Radiating Systems", International Edition, 2011
3.John D Ryder , "Netwotk Lines and fields", 2nd Edition, PHI
4. Mathew no Sadiku, "Elements of Electromagnetics ", Oxford University Press, 2003.

Reference Books:

1. Joseph A Edminister, "Theory and problems of Electromagnetics", 2nd edition, Scham's Outline series, Mc-Graw Hill International.

2. Constantine A. Balanis," Advanced Engineering Electromagnetics" John Wiley

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FLEXI CORE

VLSI DESIGN

Course Code : 17EC3301 **L-T-P-S: 3-0-2-0**

Pre-requisite: 17EC2101 **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO/PSO	BTL
1	Understand semiconductor device fabrication process and Analyze the characteristics of CMOS circuits Construction and the comparison between different state-of-the-art CMOS technologies and processes	**2,3**	**2**
2	Implement the a complete design verification process using computer-automated tools for scaling, layout, extraction, simulation, and timing analysis	**2,3**	**2**
3	Understand and analyze the design testing principle, time-delay concepts	**2,3**	**2**
4	Understand and analysis of synthesis and CMOS testing	**3,4**	**2**
5	Verify a complete a significant VLSI project and testing principles using CAD tools	**5**	**3**

Introduction to IC Technology – Wafer formation, Oxidation, Deposition, Diffusion, Ion implantation, Lithography, Etching, Metallisation, Packaging. MOS, PMOS, NMOS, CMOS & BiCMOS technologies. BASIC ELECTRICAL PROPERTIES: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit ; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Vlsi Circuit Design Processes: VLSI Design Flow, MOS Layers, Euler path-based Stick Diagrams, Concepts of lambda-based design Rules for wires, transistors and contacts, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Gate Level Design: Basic circuit concepts of sheet resistance, area capacitance applied to MOS circuits and calculations of delays for inverter circuits, Logical Effect

Circuit Design Flow: Concepts of Circuit simulation and Synthesis, Placement and Routing, Related Design capture tools, Design Verification Tools, CMOS TESTING : CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques.

Text books:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.

2. Principles of CMOS VLSI Design – Weste and Eshraghian, Pearson Education, 1999.

Reference Books:

1. VLSI Design- Dr K Lal Kishore,Dr V S V Prabhakar,IK International 2010.

LIST OF EXPERIMENTS

1. Design and analysis of CMOS Inverter.
2. Design and verify Logic gates using CMOS Logic.
3. Implementation of Boolean expressions using CMOS Logic.
4. Design of half adder using CMOS Logic.
5. Design of 2:1 MUX using Pass Transistor and Transmission Gate Logic.

6. Implementation of SR Latch using CMOS Logic.
7. Design of D-Flip Flop using CMOS Logic.
8. Physical Design and Verification of Digital Logic Cells.
9. Physical Design and Verification of SRAM cell.
10. Schematic and Physical Design of Ring Oscillator.

RF SYSTEM DESIGN

Course Code: 17EC3302 **L-T-P-S: 3-0-2-0**
Prerequisite: 17EC2212 **Credits: 4**

Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the Importance of RF Circuit Design, RF behaviour of passive components, Compare Types of Transmission Lines and represent Equivalent Circuits	**1,2**	**1**
CO2	Understand and analyse he RF diode, BJT and FET characteristics, and modelling amplifier input and output impedance matching with Graphical AID/Tool for RF Design;	**2,3**	**2**
CO3	Analyze Stability Considerations and stabilization methods to design RF Amplifiers Using Small Signal Analysis	**2,3**	**3**
CO4	Analyze high frequency oscillator configuration and mixer designs.	**3,4**	**2**
CO5	Analysis and design of RF electronic circuits	**3,4**	**2**

Syllabus

Introduction to RF System Design*:* Importance of RF and Microwave Circuit Design-Dimensions and Units- Frequency Spectrum - RF Behavior of Passive Components: High Frequency Resistors, Capacitors, Inductors, The Smith Chart: Introduction, Applications of Smith chart: Impedance measurement for single and double stub.

Design considerations of RF Filters: RF Filter Design: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion Between S- and Z-parameters, Signal Flow Chart Modeling, Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations.

Design Considerations of RF Amplifiers and Oscillators: Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers, Small signal analysis of amplifiers. Basic oscillator model-high frequency oscillator configuration.

Other Design Considerations and Real-Time Applications:

Design considerations of RF Receiver, Mixer in communication receiver, Optimization techniques. Applications: Wireless Transceiver design.

Text Books

1 Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition

2 Reinhold Ludwig and Powel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition.

Reference Books

1 Joseph . J. Carr, "Secrets of RF Circuit Design", McGraw Hill Publishers, Third Edition.

2 Ulrich L. Rohde and David P. New Kirk, "RF / Microwave Circuit Design", John Wiley & Sons.

3. Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", McGraw Hill Publishers 5th edition.

4. Devendra K.Misra , "Radio Frequency and Microwave Communication Circuits – Analysis and Design", John Wiley & Sons, Inc.

WIRELESS COMMUNICATIONS

Course Code: 17EC3303 **L-T-P-S: 3-0-0-0**
Pre-requisite: 17EC2206 **Credits: 4**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Understand the basic concepts of wireless communications & GSM Technology	**1,2**	**2**
2	Understand the basic concepts of GPRS Architecture & modulation coding schemes	**2,3**	**2**
3	Understand the basic concepts of UMTS	**2,3**	**2**
4	Understand the basic concepts of 4G LTE	**3,4**	**2**

GSM Technology: Evolution of wireless Technologies from 2G to 4G, Basic challenges in radio communication, frequency reuse concept, Multi-access techniques, the basic subsystems in GSM networks, elements in GSM networks, main interfaces in a GSM network, Air/Abis, Roaming and Handover, Location registration and location update, Capacity enhancement techniques.

GPRS Architecture (2.5G): SGSN and GGSN, tunneling and PDP Context, location area and routing area, Radio block encoding for three GPRS coding schemes, Edge Architecture (2.75G) and Modulation coding schemes.

CDMA & UMTS: Walsh codes PRN codes, Third-Generation (3G) Wireless Systems, SMS Architecture, Macro Diversity, CDMA codecs and Architectures, power control in CDMA, Handover in CDMA, UMTS architecture, UMTS authentication.

4G LTE: 4G Commitments. Relevant standards. EPC network SAE architecture, E-UTRAN and EPC

Introduction to automation: basic notions and definitions, technical and economic requisites. Automation as a means of control and inspection- basic control system concepts - control system analysis, systems of automatic control.

Text Books:

1. Timo Halonen, Javier Romero, Juan Melero - GSM, GPRS and EDGE Performance_ Evolution Towards 3G_UMTS (2003, Wiley) 4G Architecture, OFDMA in detail, MIMO in LTE, LTE Data rates, VOLTE ***Intro to Automation and Automotive Electronics***

2. An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications By Christopher Cox J .E berspäc he r, H . -J . Vöge l, C . Betts

3. GSM – Architecture, Protocols and Services Third Edition tette rand C . Hartmann, © 2009 John Wiley & Sons, Ltd.
4. Wireless information networks second edition kavehpahlavan allen h.levesque

References Books

1. ITI SAHA MISRA ”Wireless Communications and Networks”, Publisher-McGraw Hill India,

Artificial Intelligence, Artificial Neural Networks and Machine Learning

Course Code: 17EC3304 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL Credits: 4

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	To understand the concepts of Artificial Intelligence	**1,2**	**2**
CO2	To understand the concepts of neural networks	**2,3**	**2**
CO3	To elaborate machine learning methods	**2,3**	**2**
CO4	To understand the concepts of Fuzzy logic	**3,4**	**2**

Syllabus:

Introduction and Overview of AI: Meaning of AI, The AI Problems, Task Domains. Problems, Problem Spaces & Search: Defining The Problem as a State Space Search, Production Systems – BFS, DFS, Heuristic Search, Problem & Production System Characteristics, Issues in the Design of Search Programs, Common AI Problems. Knowledge Representation using Rules: Procedural vs Declarative Knowledge, Logic Programming, Forward vs Backward Reasoning, Matching & Control Knowledge.

Introduction to artificial neural networks (ANN) PDP models : Interactive and competition (IAC) and Constraint Satisfaction (CS) models. Analysis of Feedforward Neural Networks (FFNN): Overview, linear associative networks, perceptron network, multilayer perceptron, gradient descent methods. Analysis of Feedback Neural Networks (FBNN): Overview, Hopfield model, Boltzmann-Gibbs Law, simulated annealing, Boltzmann machine.

Introduction to Machine Learning, Unsupervised & Semi-Supervised Learning: Clustering (K-means, GMMS), Factor Analysis (PCA, LDA). Supervised Learning: K-Nearest Neighbour, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, Neural Networks and Gaussian Mixture Models Introduction to R Programming.

Introduction to Fuzzy logic, Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques. Natural Language processing, applications to Computer Vision and Biometrics

Text Books

[1]. Simon Haykin, Neural networks and learning machines, Pearson Education, 2016

[2]. B Yegnanarayana, Artificial Neural Networks, Prentice-Hall of India, New Delhi, 1999

Reference Books

[1]. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997

[2]. MacKay, David. Information Theory, Inference, and Learning Algorithms. Cambridge, UK: Cambridge University Press, 2003

Web References

[1]. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

[2]. https://programs.emeritus.org/mit-pe-digital-transformation/index.

17EC3305 – Electronics Instruments, Automation & Bio-Medical Applications

Course Code: 17EC3305 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL Credits: 4

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of measurement and calibration	**1,2**	**1**
CO2	Understand and study of various electronic instruments	**2,3**	**2**
CO3	Understand the basics of control systems and automation	**2,3**	**2**
CO4	Study and analysis of industrial automation	**3,4**	**2**
CO5	Design and development electronic measurement circuits suitable of automation	**3,4**	**2**

Syllabus:

Fundamentals of *Instrumentation, Buses & Electronics Instrumentation:*

Need of Instrumentation, General Instrumentation System, Static and Dynamic characteristics of instruments, loading effects of series and shunt connected instruments, Brief treatment on the types of Errors. Analog and digital measuring Instruments: Ohm meter, AC/DC Ammeter and Voltmeters. ADC, DAC, Digital instruments: Digital Multimeter, Digital Thermometer, Interfacing buses.

Basic measurements: Measurement of Resistance, Capacitance and inductive parameters temperature, pressure etc. Wheatstone bridge, Maxwell Wien bridge.

Introduction to machine vision, Introduction to robots: basic concepts - robot configurations - types of robot drives - basic robot motions - point to point control - continuous path control. Robot programming: methods - languages - capabilities and limitation - artificial intelligence – Knowledge representation – search techniques - AI and robotics. Industrial applications: application of robots in machining - welding - assembly - material handling – loading and unloading.

Basics of Biomedical Electronics: The origins of bio-potentials. Electrical activity of excitable cells, Functional organization of the peripheral nerves systems. Basic principles and detection of ECG, Electroneurogram, Electromyography, electroretinogram, electroencephalogram, magnetoencephalogram.

Applications of Bio-medical Electronics (Ex: IoT in healthcare, remote robotic controlled operations, tele-medicine, Medical Electronics Instruments etc.]

Basic theory of Computerized Tomograpgy, MRI and ultrasound imaging systems. Various detection algorithms

Bio-potential Amplifiers: Basic requirements, Problems frequently encountered, Transient protection, Common mode and other interference reduction circuits, other biopotential signal processors.

Telemedicine Internet of Things Promises–Definition– Scope–Sensors for IoT Applications– Healthcare sensors.

Text Books

1 A.K.Sawhney,—Electrical & Electronics Measurement and Instrumentation‖,10th edition, DhanpatRai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.

2 Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2003.

3 John G. Webster, Medical Instrumentation: Application and design. IV th edition, John Wiley and Sons, 2010.

Reference Books

1 Handbook of biomedical Instrumentation by RS Khandpur

2 R.Anandanatarajan, "Biomedical Instrumentation", PHI Learning, 2009.

17EC3306 – Information Theory & Coding

Course Code: 17EC3306 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL Credits: 3

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply statistical models for information source based on parameters	**1,2**	**2**
CO2	Explore the efficient coding of symbols generated by a source	**1,2**	**3**
CO3	Illustrate the importance of error control in coding	**1,2**	**3**
CO4	Efficient circuit implementation of Cyclic codes and Convolution codes	**1,2**	**2**

Syllabus:

Introduction: Information theory, measure, entropy, mark-off, statistical model, Shannon's Theorem: Introduction to Random Variables, Stationary Process, Mean, Correlation and Covariance Functions, Ergodic Process, Transmission of Random variable through LTI System, Power Spectral Density, Gaussian Process, Noise, Narrowband noise and its Representation, Fundamental limits in Information theory: Uncertainty, Information and Entropy, Source coding theorem, Data compression, Mutual information, Channel Coding theorem, Differential entropy and Mutual Information for Continuous ensembles, Information Capacity theorem and its implications, Information capacity theorem of colored noise, Rate distribution theory. Measure of Information, Mark-off Statistical Model for Information Sources, and Shannon-theorem. Encoding: Shannon Algorithms, Channels, Source/Huffman coding, Error Detection & Correction: Shannon's Noiseless Coding Theorem, Fano Coding, Huffman Coding, Arithmetic coding, Basics of Error detection & Corrections, Channels: Symmetric Lossless, Deterministic, Useless, Binary Symmetric (BSE), Binary Erase (BEC), Cascade and non-symmetric channels. Error Detection and Correction Types, Linear/Block codes, Matrix, Array, Table Look-up, Cyclic Code, BCH, RS, Golay : Introduction, Linear

Block Codes, Binary cyclic Codes, Burst Error Correcting Codes, Convolution Codes, Performance of Block Codes-Error Correction and Error Detection, Hamming Code Miscellaneous: Error Types, Burst/Random Error corr. Codes, Convolution Codes, Impulse Response, Trellis, time-domain/Transform approach, Tree representation., State representation, State-diagrams: Error Correcting Codes, Cycle Codes, Burst Correction Codes, Convolution Codes, Trellis, time-domain/Transform approach, Tree representation., State representation, State-diagrams

Text Books:

1. Communication Systems, Simon Haykin, Fourth Edition
2. K. Sam Shanmugam, Digital and Analog communication systems, John Wiley, 1996.
3. Elements of Information theory, Thomas M.Cover, Joy A.Thomas, Second edition
4. Entropy and Information theory, Robert M. Gray, First Edition

Reference Books:

1. Handbook of biomedical Instrumentation by RS Khandpur
2. R.Anandanatarajan, "Biomedical Instrumentation", PHI Learning, 2009.

Embedded Controllers

Course Code: 17EC3307 **L-T-P-S: 3-0-2-0**
Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the Interfacing of Peripherals concepts of 8051 Microcontroller through programming.	**1,3**	**3**
CO2	Understand the basic architectures of ARM 7 & AVR microcontrollers and the basic concepts of CORTEX STM-32 microcontroller and RTOS.	**2**	**2**
CO3	Apply the applications of programming with Arduino Uno	**3**	**3**
CO4	Able to identify an architectural design of available technologies and solve the societal challenge using IoT.	**3**	**2**
CO5	Apply the Interfacing of Peripherals concepts of 8051 Microcontroller through programming.	**4**	**2**

Syllabus:

Micro-controller Fundamentals: - 8051 Architecture, Timers/Counters, Interrupts - Serial Data Communication with 8051 Programming - Peripherals and Input Output with 8051 Microcontroller - Interfacing Programs.

Introduction to Modern Microcontrollers: - Introduction and Architecture of ARM7 (LPC2148), ARM7 Pin Description - Introduction to CORTEX (STM 32) - Introduction to AVR Architecture & Programming of Modern Microcontrollers (Eg: Arduino Uno & Raspberry Pi).

Applications of Micro-Controllers: - Interfacing Systems using Microcontroller Boards such as Arduino & Raspberry Pi with Sensors & Actuators (Input & output Devices) - Designing Applications with Microcontroller boards interfacing with Camera & Microphone controlling with Web-App and Mobile app - Applications of Embedded systems - Washing machine, Automobiles and other applications (Microwave Oven, Smart Refrigerators, Smart Watch).

Advanced Applications of Embedded Systems: - Introduction to RTOS (Real Time operating systems) and applications - IoT Based Embedded System Design: Overview, characteristics, Distributed Embedded Architectures: Physical and logical design and functional blocks - Applications of IoT: Home automation, Industry applications, Surveillance applications and other IoT applications.

Text Books

1 Mazidi&McKinley "The 8051 Micro controller and Embedded systems: using assembles and C, 2nd edition, 2007.
2 Introduction to Embedded Systems -Shibu K.V, McGraw Hill, 2009.
3 Embedded Systems - Raj – Kamal, Second Edition TMH, 2009.
4 Internet of Things, A Hands-on Approach – Arshadeep Bahga, Vijay Madisetti, Universities Press Pvt. Ltd., 2015.

REFERENCE BOOKS:

1 Frank Vahid, "Embedded System Design", Wiley; Student edition (2006).
2 Make: Arduino Bots and Gadgets: Six Embedded Projects with Open Source Hardware and Software by TeroKarvinen, Kimmo Karvinen
3 Practical Microcontroller Engineering with ARM Technology by Ying Bai
4 The Internet of Things - Qusay F. Hassan, CRC Press, 2018.

Web References

1 https://www.youtube.com/watch?v=4t6TTi2scWI
2 https://www.youtube.com/watch?v=FOrs4ffP-Wc
3 https://www.youtube.com/watch?v=gAAUAZiQlhQ
4 https://www.youtube.com/watch?v=yFIiJ6bJUNE
5 https://www.youtube.com/watch?v=fI20Bsx3EPM
6 https://www.youtube.com/watch?v=SCdJJowb8h8
7 https://www.youtube.com/watch?v=iP-HMg1_u0I
8 https://www.youtube.com/watch?v=s2AKMERnBhQ
9 https://www.youtube.com/watch?v=aMfkguxbcmM
10 https://www.youtube.com/watch?v=Tx1kFTzCRFc
11 https://www.youtube.com/watch?v=hMPqowfFruo
12 https://www.youtube.com/watch?v=OfGxbxUCa2k
13 URI: http://dspace.kluniversity.in/handle/123456789/38694
14 URI: http://dspace.kluniversity.in/handle/123456789/33142

PROFESSIONAL ELECTIVES

EMBEDDED CONTROLLERS, IOTS & POWER ELECTRONICS

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Wireless sensor Networks & IOT Applications

Course Code: 17EC3611 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understanding of wireless sensor network technologies.	**3**	**3**
CO2	Study of BLE protocols in WSN security and power applications.	**3**	**2**
CO3	Study and application of IOT and WSN for smart cities/ villages.	**3**	**2**
CO4	Study of various IoT application in various domains	**3,5**	**2**

Syllabus:

Basics of Wireless Sensor Networks: Introduction to WSN, Basic Overview of Wireless Technology, Basic Sensor Network Architectural Elements, Challenges, Applications of WSN. Some Examples of Sensor Nodes, Sensor Network Scenarios, Optimization Goals and Figures of Merit. Gateway and Router Concepts. Network Topologies: Single Hop Star, Multi Hop Mesh and Grid, Two-Tier Hierarchical Cluster.
WSN, Bluetooth & Other Protocols and Standards: Classifications of MAC Protocols for WSN, Sensor-MAC Case Study. Routing Protocols and Strategies in WSN, WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation (Optional). ZigBee/IEEE802.15.4, IEEE 802.11/a/b/g, IEEE 802.16, Bluetooth, BLE, Infrared, Differences in range, Security, Power. Bluetooth, BLE and 6LoWPAN.
IoT & Smart Cities: IoT Applications in Smart Cities, WSN for Smart Cities, WSN Design Issues for Smart Cities, Performance Metrics. Garbage Disposal, Vehicle Management, Smart Home, Smart Grid, Smart-Village. IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View
IoT Applications: Healthcare, Wearables Dairy, Agriculture, Traffic Monitoring & Control, Pollution Management, Inter-Vehicular Communication, Vehicle Tracking, Finance Transaction. Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations

Text Books

1 Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007
2 Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network",
John Wiley and Sons, 2005
3 Arshadeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on Approach", Universities Press Pvt. Ltd., 2015.

Web References

1 https://www.betteru.in/course/wireless-sensor-networks-online-course-certificate/
2 https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/
3 https://www.youtube.com/watch?v=7h5Wwk_mheg
4 https://www.youtube.com/watch?v=-oWlS66__Qo
5 https://www.youtube.com/watch?v=m45SshJqOP4

6 https://www.youtube.com/watch?v=D3yrk4TaIQQ

Solar Photo-Voltaic cells & Solar Power Arrays

Course Code: 17EC3612 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of solar photo-voltaic cell structure	**3**	**3**
CO2	Study of basic physics and components of solar photo voltaic cells	**3**	**2**
CO3	Study and design of solar PV systems and testing	**3**	**2**
CO4	Analysis and design of SPV arrays	**3,5**	**2**

Syllabus:

Solar Photovoltaic Fundamentals and Characteristics: Structure, operations and characteristics of photodiode and solar cells. Photovoltaic Cells: Basic structure, materials and equivalent circuits. PV output Characteristics, performance testing of cells and efficiency. Introduction to PV modules, panels, string, arrays, sub array and blocking diodes.

Solar Photovoltaic Materials and SPV cell Production: Crystalline and amorphous silicon solar cells: Properties, production process, cells and modules, thin film solar cells, III-V solar cells, CdTe, CIGS, DSSCs, organic, hybrid and perovskite solar cells. Different techniques of solar cell fabrication and assemble: multi junction, stack (hybrid and HIT), concentrated solar cells and arrays.

Solar Photovoltaic Systems Design, Testing and Optimisation: Solar PV system design: design consideration, process and design aid expert. Performance test procedure for panels: Performance measurements, module reliability, stability and qualification testing. Voltage regulation: Grid connected structure, affine parameterization, sizing systems, feed forward control and PID controllers.

Solar Photovoltaic Arrays, Configurations and Applications: PV modules and arrays: module configuration, array topology optimization and fixed array topology. Based on SPV Application design and system reliability improvements: failure modes and effect analysis, fault tree models. Artificial Intelligence, Artificial Neural Networks and Machine Learning application for SPV systems in design reliability analysis, fault detection and fault tolerant systems.

Text Books

1. Jenny Nelson, The Physics of Solar Cells, Imperial College Press (2003)
2. Solar Photovoltaic's: Fundamentals, Technologies and Applications, C. S. Solanki, 2ndEdition, Prentice Hall of India, 2011
3. A. Freundlich, P. Verlinden, Wvan Sark, Photovoltaic Solar Energy: From Fundamentals to Applications, John Wiley & Sons Ltd. 2017.
4 Konrad Mertens, Photovoltaics: fundamentals, technology and practice Chichester, West Sussex, United Kingdom: John Wiley & Sons Inc., 2014.

Reference Books

1. Kaushika, N.D, Solar Photovoltaics Technology, System Design, Reliability and Viability, Springer, 2018
2. Reccab Manyala, Solar Collectors and Panels, Theory and Applications, Intech open, 2010

3. A. K. Mukerjee, nivedita thakur, Photovoltaic Systems: Analysis and Design, PHI Learning Pvt. Ltd., 2011
4. John Wiley & Sons, Inc, Crystalline Silicon Solar Cells, Goetzberger-Knobloch-Voss, 1998: Crystalline Silicon Solar Cells, 1998
5. Angèle Reinders, Photovoltaic Solar Energy: From Fundamentals to Applications, John Wiley & Sons, 2017
6. Weidong Xiao, "Photovoltaic Power System: Modeling, Design, and Control", Wiley, 2017

Web References

1 https://www.pveducation.org/
2 http://www.alternative-energy-tutorials.com/solar-power/photovoltaics.html
3 https://www.nrel.gov/research/re-solar.html
4 http://www.fsec.ucf.edu/en/consumer/solar_electricity/index.htm
5 https://nptel.ac.in/courses/115107116/
6 https://www.open.edu/openlearn/nature-environment/environmental-studies/energy-resources- solar-energy/
7 https://www.coursera.org/learn/photovoltaic-solar-energy/

Electronic Systems for Renewable Energy & Smart Grid

Course Code: 17EC3613 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits: 4**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of renewable energy electronics	**3**	**3**
CO2	Study and analysis of electronics systems for renewable energy sources	**3**	**2**
CO3	Analysis and study of smart grid sub-systems and circuits	**3**	**3**
CO4	Analysis of electrical smart grids	**3,5**	**2**

Syllabus:

Introduction to Renewable Energy Sources: Introduction to Renewable Energy, Types of Renewable Energy, Solar power, solar resource, hybrid systems, wind resource and wind firm, Electronic Power Converters in Wind Turbines and Solar Photo voltaic Systems.

Electronics Systems for Renewable Energy Sources: Grid Monitoring and state estimation: Introduction, method of state estimation, algorithms for state system, sensors for grid monitoring: feeder sensors for SCADA, distributed energy resource sensors, metering sensors, portable and temporary sensors, Managing Data: meter data management, smart metering rollout, delivering bill-ready meter data.

Smart Grid Sub-systems and Circuits: Asset management and conditioning monitoring, smart grids and condition monitoring, Reliability indices: Introduction to distribution system reliability, reliability assessment with distribution automation: Fault indicator DA scheme, DA scheme using sequential coordinated re-closers, automated smart load restoration DA scheme.

Electrical Smart Grids: Smart customer and smart Home, From Smart Grid to Smart cities to IOT: opportunity, looking to future. Enhancing smart grid stability with the implementation of heuristic algorithms. Advanced metering infrastructure, Smart grid cyber security, Smart grid communications, Restructuring of power systems.

Text Books

1 Vaughn Nelson, "Introduction to Renewable Energy" CRC Press, 1st edition, 2011.

2 Ahmad Hemami, "Electricity and electronics for renewable energy technology: an introduction",Taylor & Francis,2016

Web References

1 https://nptel.ac.in/courses/117108141/
2 https://onlinecourses-archive.nptel.ac.in/noc18_ee42/preview
3 https://www.youtube.com/watch?v=2XWIiS6M_-g
4 https://www.youtube.com/watch?v=AbNXbLm4iUs
5 https://www.youtube.com/watch?v=JwRTpWZReJk
6 https://www.youtube.com/watch?v=Ft8nAo5hzdQ

IOT Applications for Smart Cities

Course Code: 17EC3614 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of smart cities/villages/living	3	2
CO2	Study of systems for smart cities with case studies.	3	2
CO3	Analysis and design of smart grid sub-systems and circuits	3	4
CO4	Study of advanced topics related to privacy, scaling and design considerations.	3,5	2

Syllabus:

Introduction to Smart Cities, Smart Villages and Smart Living:

- Characteristics of Smart Cities- Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living.
- Introduction to IoT and Architecture, Introduction to IoT for Smart Cities.
- IoT based solutions for Smart Cities – Smart Grid, Smart Home, Transport and Traffic Management, Smart Healthcare.
- Challenges- Planning, Cost and Quality, Security and Privacy, Risks,
- IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Systems for Smart Cities:

- World's Examples- International and National Case Studies.
- Network Infrastructure for Smart Cities, Emerging Technologies, Challenges and Concerns.
- Systems for Smart Cities: Smart Grid, Smart Vehicle Tracking, Security, Traffic, Pollution, Smart Home, Advanced Safety & Security Systems, Smart Water Management, Smart Waste Management, Smart Buildings, Smart Mobility, Smart Economy, Smart Environment, Smart Energy and Healthcare.
- IoT Systems Design Methodology for Smart Cities Applications.
- ICT for Smart Cities - ICT Architecture, Major Technology Areas, ICT Systems for Smart Cities.

Designing IoT Systems for Smart Cities:

- Designing Systems for: Home Automation, Street Lighting, Advanced Safety & Security Systems, Garbage Disposal, Vehicle Management, Smart Home, Smart Money.

- IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT.
- Miscellaneous Topics: Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry.

Design Considerations, Economics and Issues in IoT Applications:

- IP Protection, Security, Privacy and Scaling issues in IoT for Smart Cities.
- Trust in IoT-Data-Platforms for Smart Cities.
- First Steps Towards a Secure Platform, Data Aggregation for the IoT in Smart Cities.
- Design Considerations, Economics.
- Introduction to M2M to IoT, M2M Value Chains, IoT Value Chains, M2M to IoT-An Architectural Overview.

Text Books

1 Ejaz, Waleed, and Alagan Anpalagan. Internet of Things for Smart Cities: Technologies, Big Data and Security. Springer International Publishing, 2019.

2 P P Anil Kumar, Introduction to Smart Cities, Pearson India; First edition, 2019.

3 Michael Miller, "The Internet of Things How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", Pearson Education, 2015.

REFERENCE BOOKS:

1 Arshadeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on Approach", Universities Press Pvt. Ltd., 2015.

2 Stan McClellan, "Smart Cities in Application: Healthcare, Policy and Innovation", Springer.

3 Schahram Dustdar, "Smart Cities: The Internet of Things, People and Systems", Springer, 2017.

WEB REFERNCES:

1 IoT-From Research and Innovation to Market Deployment_IERC_Cluster_eBook_978-87-93102-95-8_P.pdf

MOOCS:

1 https://www.coursera.org/specializations/developing-industrial-IoT

2 https://www.coursera.org/learn/smart-cities

VLSI & MICRO – ELECTRONICS
LOW POWER VLSI

Course Code : 17EC3621 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Understand the physics of power dissipation including short circuit power, dynamic power and leakage power, techniques that makes a low power circuit and introduction to simulation power analysis	1,3	1
2	Illustrate probabilistic power analysis and apply low power techniques at circuit level for CMOS circuits	1,3	3
3	Apply low power techniques at gate level, architecture level and system levels	3	1

4	Illustrate essential tasks in algorithm and architecture level low power design environments and Apply low power clock tree distribution techniques to create low power devices	3,4	2

Introduction: Need for low power VLSI chips, Emerging Low Power Approaches, Sources of Dissipation in Digital Integrated Circuits, Basic Principles of Low Power Design, Physics of power dissipation in CMOS FET Devices,noise margin.

Probabilistic Power Analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques. **Circuit**: Transistor and Gate Sizing, Network Restructuring and Reorganization, Flip Flops & Latches design, low power digital cells library. **Logic Level:** Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.
Low Power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.
Low Power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation.
Special & Advanced Techniques: Power Reduction in Clock Networks, CMOS Floating Node,Power gating techniques,Low Power Bus, Delay Balancing, Low Power Techniques for SRAM,Adiabatic Computation, Pass Transistor Logic Synthesis, Asynchronous Circuits.
BoS Approved Text books:
1. Gary Yeap, “Practical low power digital VLSI design”, Kluwer Academic Publishers, 2002
2. MassoudPedram, Jan M. Rabaey , “Low power design methodologies “, Kluwer Academic Publishers
BoS Approved Reference Books:
1. Kaushik Roy, Sharat Prasad, “Low Power CMOS VLSI Circuit Design”, Wiley, 2002
2. Yeo “CMOS/BiCMOS ULSI low voltage low power,”, Pearson Education Publishers, Boston, 1995. (Added)

IC DESIGN AND IT’S APPLICATIONS

Course Code : 17EC3623 **L-T-P-S : 3-0-0-0**

Pre-requisite : NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO/PSO	BTL
1	Understand the physics of power dissipation including short circuit power, dynamic power and leakage power; inverter delay	1,3	2
2	Illustrate the design procedure of static and dynamic CMOS circuits	1,3	2
3	Illustrate the design procedure of sequential logic gates and clock synchronization	3	3
4	Discuss the design procedure of arithematic building blocks and memories	3,4	2

MOS Inverters: Introduction, Definitions and Properties, Static CMOS Inverter, Static and Dynamic Power Dissipation, CMOS inverter delay time definitions and calculations

Designing Combinational Logic Gates in CMOS: Introduction, Static CMOS Design, Dynamic CMOS Design, Power Consumption in CMOS Gates.

Designing Sequential Logic Gates in CMOS: Introduction, Static Sequential Circuits Dynamic Sequential Circuits, Non-Bistable Sequential Circuits, Logic Style for Pipelined Structures. Timing Issues in Digital Circuits**:** Introduction, Clock Skew and Sequential Circuit Performance, Clock Generation and Synchronization.

Designing Arithmetic Building Blocks: Introduction, The Adder: Definition, Circuit and Logic Design, The Multiplier: Definition, The Shifter: Definition, Power Considerations in Data path Structures. Designing Memory: Introduction, Semiconductor Memories - An Introduction, The Memory Core: RAM, ROM, Memory Peripheral Circuitry

Text books:

1. Gary Yeap, "Practical low power digital VLSI design", Kluwer Academic Publishers, 2002
2. Massoud Pedram, Jan M. Rabaey , "Low power design methodologies ", Kluwer Academic Publishers

Reference Books:

1. Kaushik Roy, Sharat Prasad, "Low Power CMOS VLSI Circuit Design", Wiley, 2002
2. Yeo "CMOS/BiCMOS ULSI low voltage low power,", Pearson Education Publishers, Boston, 1995. (Added)

VLSI Sub-system Design and Design for Testability

Course Code : 17EC3624 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the design flow and methodologies of VLSI sub-system	**1,3**	**3**
CO2	Study of memory and array sub systems	**1,3**	**1**
CO3	Analysis of fault tolerant designs	**3**	**1**
CO4	Design of testing of VLSI systems	**3,4**	**1**

Syllabus:

Design Methodology: Structured design techniques; Programmable logic; Gate array and sea of gates design; cell-based design; full custom design; Design flow; Design Economics. Data path Subsystems: Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off.

Memory and Array Subsystems: SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array yield, reliability; Power dissipation in Memories. Special purpose Subsystems: Packaging; power distribution; I/O pads.

Fault Tolerant Design: Importance of fault tolerance, Basic concepts of fault tolerance, Static redundancy, schemes of fault redundancy, Time redundancy, Software redundancy, Fail-Safe Operation, Fault table method, kohavi algorithm, Path sensitization, Boolean difference.

Design for Testability: ATG for SSFs in combinational and sequential circuits, Detection of bridging faults, Functional fault testing models, Ad Hoc design and design for testability techniques, Generic scan-based designs, some advanced scan concepts, BIST architectures.

Text Books

1 Neil H. E. Weste, David. Harris and Ayan Banerjee, "CMOS VLSI Design" - Pearson Education, Third Edition, 2004.

2 Miron Abramovici, Melvin A. Breuer, Arthur D. Friedman, "Digital Systems Testing and Testable Design" Revised Printing, IEEE Press, New York.

Reference Books

1 Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, Second Edition.

2 P. K. Lala," Fault Tolerant and Fault testable hardware design", BS Publication

3 Michael L. Bushnell &Vishwani D. Agrawal," Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwar Academic Publishers. 2000.

4 N.N.Biswas "Logic Design Theory" PHI.

AUTOMATION & ROBOTICS

Control Systems & Introduction to Robotics

Course Code : 17EC3631 **L-T-P-S : 3-0-0-0**

Pre-requisite : NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of control systems	**1**	**3**
CO2	Analysis of control systems in time and frequency domains	**1**	**1**
CO3	Understanding the basics of robotics	**1,3**	**1**
CO4	Understand and apply kinetics, dynamics and control of robots.	**1,3**	**1**

Syllabus:

***Control System Basic Concepts*:**

Basics: Terminology, Examples, Open Loop, Closed Loop Control Systems, Types of control systems, Errors, Error Margins. Mathematical Models of physical systems: Formulation of Differential equations for Transfer Functions of DC & AC Servomotors.

Block diagram of control systems; Signal flow graph, Mason's gain formula.

***Time and Frequency Domain Analysis*:**

Standard Test *signals* – Step, Ramp, Parabolic and Impulse; Impulse Response.

Characteristic Equation of Feedback systems, Transient Response of First order and Second order Systems, Steady state error and Error constants. Introduction to *PID* and *PID Controllers Stability analysis:* Concept of stability and conditions for stability, Routh – Hurwitz criterion (optional), dominant poles of *transfer function. Root Locus Technique:* Root Locus concept, basic properties, magnitude and angle conditions, effects of adding poles and zeros to G(s) H(s). *Frequency response*: Specifications, correlation, Bode-plot, phase margin, gain margin.

***Introduction of Robotics**:*

Types of robots, Classification, usage, and the diverse *Applications* of Robots.

Mathematical Representations of Robots: Position and orientations of rigid body, Homogeneous transformations, Representation of joints, Link representation using D- H parameters. Different kinds of *Actuators:* Stepper, DC servo and AC motors

Different Types and Ranges of *Sensors:* Internal and External sensors.

Common Sensors – encoders, tachometers, strain gauge-based force-torque sensors, proximity and distance measuring sensors

Kinematics, Dynamics Motion Planning and Control*:*

Kinematics: for Robotic Arm and Robots, Planning of Manipulator Trajectories, Control and Kinematics, Serial and Parallel manipulators, Direct and Inverse Kinematics.

- *Degrees of Freedom & Dynamics:* Parallel mechanisms, Constraint equations, Velocity and Static Analysis, Formulation of Equations of Motion, Recursive Dynamics.
- *Simulations* of robots using MATLAB / PHYTHON.
- *Robot Control Techniques*, Position and Force Control, Modeling and Control of Robots. Design of slip-free Wheeled Mobile robots.
- *Advanced Topics in Robotics:* Nonlinear dynamics, Chaos HMI, BMI and Humanoid.

Text Books

1 J. Nagrath & M Gopal, "Control System Engineering", 5th Edition, New Age International Publication, New Delhi (2011).

2 B. C. Kuo," Automatic Control Systems", Eighth Edition, Prentice Hall India Publications, New Delhi , (2010).

3 A. Ghosal, "Robotics: Fundamental Concepts and Analysis", Oxford University Press, 2nd reprint, 2008.3.

4

5 1. J. Nagrath & M Gopal, "Control System Engineering", 5th Edition, New Age International

6 Publication, New Delhi (2011).

Reference Books

1 K Ogata, "Modern Control Engineering", Fifth Edition, Prentice Hall India Publication, New Delhi , (2010).

2 M. Gopal, "Control Systems Principles and Design", Fourth Edition, Tata Mc-Graw Hill Publications, (2012).

3 K. Fu, R. Gonzalez, and C. S. G. Lee, "Robotics: Control, Sensing, Vision and Intelligence", McGraw - Hill, 1987.

19EC3072 – Autonomous Vehicles & Automotive Electronics

Course Code: 17EC3632 **L–T–P–S: 3-0-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understanding the basics of autonomous vehicles	**1**	**3**
CO2	Understand the principles of sensors and actuators	**1**	**1**
CO3	Analysis and understanding of automotive electronic systems	**1,2**	**1**
CO4	Study of various miscellaneous topics	**1,2**	**1**

Syllabus:

Introduction to Autonomous Vehicles :Technological overview concepts of Autonomous Vehicles (AVs); History of Autonomous Vehicles; Vehicle Electronics Architecture; Vehicle Operating Software; Functional Block Diagram of typical Autonomous Vehicle System (AVS); Society of Automotive Engineers Levels of Automation; Major Functions of physical Ecosystem of an Autonomous Vehicle (cameras, radar, lidar, gps, ultrasonic sensors, central

computer, DRSC-based Receiver); Autonomous Vehicle architecture (JAUS & GOA); **Driver Assisted/Driverless Vehicles, Connected Vehicles:**
Basic control system applied to Drive Assisted, Driverless, Connected Vehicles; Overview of the operation of Electronic Control Unit (ECUs); Basic cyber-physical system theory and autonomous vehicles; Comparison chart of deriver assisted vs driverless vehicle and connected Vehicles vs Autonomous Vehicles. **Automotive Sensors** : Role of sensors and actuators in autonomous vehicles; Schematic principle of Autonomy and automotive sensors; Sensor characteristics**,** Hall phase, Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Mass air flow (MAF) rate, Exhaust gas oxygen concentration, Throttle plate angular position, Crankshaft angular position/RPM, Manifold Absolute Pressure (MAP), Differential exhaust gas pressure and Air bag sensors, Sensor Testing and Calibration **Automotive Actuators (AA) :** Automotive Engine Control Actuators, Fuel Injection, Exhaust Gas Recirculation Actuator, Variable Valve Timing, VVP Mechanism Model, Electric Motor Actuators. **Automotive Transmission (AT) :** Transmission fundamentals, Types MT, AT, CVT and DCT, ATS, Clutch, characteristic studies of Gear Box, epicyclic gear arrangement. **Microcontrollers for Automotive (AM):** Criteria to choose the right microcontroller/processor for various automotive applications; Understanding various architectural, Dynamometer testing. Vehicle Control, Power train, Driver Information, Motor Control Technologies: Toshiba offers microcontrollers, Vector Engine (VE), Automotive MCU. **Automotive Control System & Model Based Development [1-2]:** Control system approach in Automotive Electronics, Modelling of Automotive Systems with simple examples. Model based Development: Introduction to MATLAB, Simulink and SIMSCAPE toolboxes.

Automotive Electronics (AE)

Fundamentals of Automotive Electronics (FAE): Principles of automotive systems **Advanced driver-assistance systems (ADAS):** Evolution of ABS configurations, Basics of Theory of Operation, Integration of ADAS Technology into Vehicle Electronics, ADAS in Toyota, Nissan, Honda, Hyundai, Volkswagen, BMW, General Motors. **Bluetooth low energy and the automotive (BLE-AE):** Functional view of BLE; BLE-enabled Vehicle access block diagram; operation of Smart vehicle access using BLE, Driver assistance and personalization using BLE-AE, Piloted/assisted/remote parking BLE-AE.

Automotive Wireless (AW) : Wireless Networking and Applications to Vehicle Autonomy; Integration of Wireless Networking and On-Board Vehicle Networks; Wireless Access in Vehicular Environments (WAVE) amendment to IEEE 802.11; IEEE 802.11ac WLAN PHY and dual-band (2.4 GHz/5 GHz) support ; EEE 1609 - Family of Standards for Wireless Access in Vehicular Environments (WAVE). **Automotive GPRS Vehicle Tracking (AGPRS-VT)** Vehicle Tracking System; Principle of working for Vehicle Tracking system. GPS and GPRS tracking system

Embedded to Automotive Electronics and autonomous Vehicles [4-5]:

Controlled Area Network (CAN): Basic, Block diagram of the CAN bus architecture, Types of CAN Physical Layers, Frame Format of CAN protocol, Working principle of CAN communication. **Local Interconnect Network (LIN) :** Basic, LIN workflow concepts, LIN frame, header concepts, IN Checksum Calculation and Verification, applications.

FlexRay Consortium : Basics, Working, Clock synchronization, Single Edge Nibble Transmission) protocol: SENT protocol structure, Basic Concepts and Fast Channel Data Transmission, **Media Oriented Systems Transport (MOST):** Principles of communication operations, Competing standards. **Vehicle Area Network (VAN):** basic architecture of VAN, operational view of VAN, Integrated to Automotive Electronic Protocols: EBD, Electronics stability programs (ESP), PA Industrial control system protocols: Open Platform

Communications (OPC), Remotely Piloted Vehicles (RPVs); Unmanned Aerial Vehicle (UAV). **Manifold Absolute Pressure Sensor (MAP sensor):** Basic architecture, operation, applications, testing procedure of MAP. Electronic Control Units (ECU), Vehicle Networking & Diagnostics Stacks; Automotive Functional Testing: The Process Flow-diagram. HIL Testing, MIL Testing, SIL Testing.

Text Books

1 Crating Autonomous Vehicle Systems by shaoshan liu, liyun li
2 Autonomous vehicles: opportunities, Strategies, and Disruptions by Michael McGrath
3 Reinventing the automobile: personal urban mobility for the 21st century (the MIT Press) by William J. Mitchell, Chris E. Borroni-Bird, Lawrence D. Burns.
4 Tom Weather Jr and Cland C. Hunter, “Automotive Computers and Control System” Prentice Hall Inc., New Jersey
5 Understanding Automotive Electronics an Engineering Perspective Seventh edition William Ribbens.
6 Automotive Power Transmission Systems Yi Zhang University of Michigan-Dearborn USA Chris MiSan Diego State University USA.
7 Automotive Embedded Systems Handbook CRC Press Taylor & Francis Group Richard Zurawski
8 Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive Robert Bosch GmbH (Ed.) 5th Edition
9 William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998 Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.
10 Marc E. Herniter and Zac Chambers: “Introduction to Model Based System Design”, RoseHulman Institute of Technology. Rudolf Limpert, “Brake design and Safety”. SAE Publications, 2015,

Web References

1 https://toshiba.semicon-storage.com/ap-en/product/automotive/micro.html
2 https://www.tesla.com/autopilot
3 https://www.audi.com/en/experience-audi/mobility-and-trends/autonomous-driving.html
4 https://global.toyota/en/mobility/
5 https://www.mazdausa.com/

19EC4073 – Advanced Robotics

Course Code: 17EC3633 **L–T–P–S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understanding the fundamentals of robotics	**1**	**1**
CO2	Analysis and understanding the various parameters of robots	**1**	**1**
CO3	Analysis and understanding the mechanisms involved in various robots.	**1,2**	**1**
CO4	Analysis of various case studies and humanoid applications of robots	**1,2**	**1**

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Syllabus:

Introduction to Robotics (ITR): [3-4]
Brief History, Types of Robots; Technology of Robots, Basic Principles in Robotics; Mathematical Representation of Robots; Robot Hardware; Obstacle Avoidance, Task Planning and Navigation; Robot Vision; Artificial Intelligence Applications of real-world Environments (Driverless, Unmanned Aerial Vehicles (UAV), and Tele-robots), Introduction to Robotic Operating System (ROS)

Robotics Foundation: [4-6]
Degrees of Freedom (DoF), Six Degrees of Freedom (6DOF), Mobility formula, Three Laws of Robotics; Asimov's Laws(AL), Dynamic Stabilization(DS), Advanced Robotics Sensors(ARS), Power Sources(PS), Force Control(FC), Ring LASER, Gyro Sensor(GS), Inertial Navigation(IN), Terrain a Mapping (TaM), Contour following direct and inverse kinematics problems and workspace,Kinematics. Motions and dimensions; Robotics Components, Power, types of Robot Sensors.

Advanced Robotic Manipulator & Actuator (ARM & ARS) [8-10]:
Industrial Robot Manipulator: Manipulator Structures, Kinematics of Serial and Parallel Manipulators, Velocity Analysis and Statics of Manipulators, Dynamic of Manipulators, Trajectory Planning and Generation(P&G), position and Force control of Manipulators, Modelling and Control of Flexible Manipulators, Modelling and analysis of Wheeled Mobile Robot; 3D LASER Doppler Vibrometer, Magnetic Levitation Control, Inverse Kinematics solution for general 6R manipulator. Joint Actuating System; Servomotor; Grippers, AR in Path Planning Algorithm, Hill-Climbing, Design Consideration Macrobiotics.

Varieties of Robots & Advanced Robotics Heterogeneity (ARH) [8-9]: Design Studies on Boston Dynamics Products: Cheetah, Atlas, SpotMini, Legged Robots, Wheeled Robots, Mobile Robots, Telerobots, Service Robots; Design considerations On: Large Robots, Miniature Robot(Swarm robotics), Auto-bots, Swarm-Robotics, Micro-bots, wheeled mobile robots, bipeds,KUKA Collaborative Robot Serie, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots, Introduction to Autonomous Electric Vehicles(AEVs).

Case Studies, Applications & Humanoid [8-10]:
[i]: Robot Assembling: Assembly of robots using Lego, Vex and Tetrix Kits – Five-minute bot, Line follower, Obstacle avoidance robot, Wall following robot; Coordinated Multi-Robot Exploration; Mapping and Localization in Non-Static Environments.
[ii]: Programming: Programming of robots using NXT software, Robot C and python programming -advanced path planning robots. **e-Yantra Firebird Kit**: Introduction, Architecture, programming using Atmel studio, Programming: Buzzer, Line following, LCD display.
[iii]: Case Studies: Multiple Robots, medical robots: image guided surgical robots, radiotherapy, cancer treatment.
[iv]: Miscellaneous Applications: Industrial /Home/Defense Applications, painting robots, image guided Surgical Robots (SR], Cancer Treatment Robot (CTR)

Textbooks

[1]. Industrial Robotics Technology, Programming and Applicationsby M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey
[2]. Ashitava Ghosal - Robotics - Fundamental concepts and analysis-Oxford University Press (2006)
[3]. Anis Koubaa, Hachemi Bennaceur, Imen Chaari, Sahar Trigui, Adel Ammar, Mohamed-Foued Sriti, Maram Alajlan, Omar Cheik hrouhou, Yasir Javed Series: Studies in Computational Intelligence Publisher: Springer, Year: 2018ISBN: 978-3-319-77042-0,978-3319770406

[4]. Springer Tracts in Advanced Robotics Volume 55 Editors: Bruno Siciliano · Oussama Khatib · Frans Groen

Reference Books

[1]. Mikell P Groover, Automation, Production Systems, and computer integrated Manufacturing‖, Prentice Hall, 2001.
[2]. Introduction to Roboticsby S. K. Saha
[3]. Introduction to Robotics–Analysis Systems, ApplicationsbyS. B. Niku.
[4]. Robotics: ―Fundamental Concepts and Analysis by A. Ghosal
[5]. Industrial Robot Programming–Building Application for the Factories of the Future by Pires
[6]. Image Guided Interventions – Technology and Applications‖, Springer by Peters

COMPUTER VISION APPLICATIONS

Course Code: 17EC3634 **L–T–P–S: 3-0-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co. No.	Course Outcome's	PO	BTL
1	Understanding of the fundamental concepts related to multi-dimensional signal processing.	1	3
2	Understanding of the feature extraction, pattern analysis visual geometric modelling, stochastic optimization.	1	1
3	Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision.	1,2	1
4	Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering.	5	2

Image formation and Image Processing: Introduction to Computer Vision; Geometric primitives and transformations: Geometric primitives, 2D transformations, 3D transformations, 3D rotations, 3D to 2D projections; Image Processing: Histogram Processing, Linear filtering, Fourier transforms, Image Enhancement, Restoration.

Local Image Features Extraction: Edges: Edge detection, Edge linking; Lines: Hough transforms, Orientation Histogram, HOG, SIFT, SURF; Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Image Segmentation and Recognition: Active contours: Snakes, Dynamic snakes and Condensation, Scissors, Level Sets; Graph-based segmentation, Texture Segmentation; Object detection: Face detection, Detecting Humans, Detecting Boundaries, Datasets and Resources.

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians; Classifiers: SVM, ANN, CNN; Dimensionality Reduction: PCA, LDA, ICA.**Case Study and Simulations:** Study how Facebook, Google, Netflix, LinkedIn, Instagram and Amazon use various image processing algorithms for face recognition, human identification, scene analysis and content analysis. Develop a computer vison model for face detection in the wild on KLEF campus.

Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2011.

References:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

Human Machine Interface & Brain Machine Interface

Course Code: 17EC3635 **L–T–P–S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**
Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	Understand the Basic Idea of Human Machine Interactions, and its Goals	1	3
2	Explain the capabilities of both humans and computers from the viewpoint of human information processing	1	1
3	Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms	1,2	1
4	Apply an interactive design process and universal design principles to designing HCI systems	1,2	1

Introduction: Historical evolution of the field, Concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques.

Model-based Design and evaluation: Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS, Fitts' law and Hick-Hyman's law, Guidelines in HCI: Norman's seven principles, Norman's model of interaction, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.

Empirical research methods in HCI: Experiment design and data analysis (with explanation of one-way ANOVA), Task modelling and analysis through Hierarchical task analysis (HTA), Dialog Design using FSM (finite state machines), Cognitive architecture, Object Oriented Modelling of User Interface Design.

Design -Case Studies: 1. Multi-Key press Hindi Text Input Method on a Mobile Phone, GUI design for a mobile phone based Matrimonial application, Employment Information System for unorganised construction workers on a Mobile Phone.

Text Books:

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.

Reference Books:

1. B. Shneiderman; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).

SIGNAL PROCESSING

Speech Signal Processing

Course Code: 17EC3641 **L–T–P–S: 3-0-0-0**

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Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of speech signal processing	**1,3**	**3**
CO2	Understand and applications of various transformation techniques for filter.	**1,3**	**2**
CO3	Understand the concepts and methods of aliasing, auto correct and filtering.	**1,3**	**2**
CO4	Analysis and understand advance topics in speech signal processing.	**5**	**2**

Syllabus:

SPEECH FUNDAMENTALS: Production and Classification of Speech Sounds; Acoustic Phonetics – Vowels, diphthongs, fricatives etc., Speech parameters-Speech production, Labelling.
TRANSFORMATIONS FOR SPEECH SIGNAL PROCESSING: Fourier Transformation, Design of Filters- Wide band and Narrow Band- Hilbert transform- Auto correlation and Hilbert huang transforms for pitch estimation- STFT- STFT representation of speech - Z transform and Pole Zero concepts, LTI, Modelling of speech: Inverse filtering, Pole zero, Z transform.

ANALYSIS AND SYNTHESIS OF SPEECH:
Speech Analysis: Time domain: Analysis and Synthesis of Pole-Zero Speech Models; Aliasing, Spectral: Short Time Fourier analysis - filter bank design - speech coding – subband coding of speech - transform coding - channel vocoder - vector quantizer coder. introduction to LPC.
Speech synthesis - Pitch extraction algorithms, MFCC- autocorrelation pitch trackers - voice/unvoiced detection - homo morphic speech processing - homomorphic systems for convolution - complex cepstrum - pitch extraction using homomorphic speech processing. Introduction to vowel synthesis.
ADVANCED TOPICS and APPLICATIONS OF ANN, AI and ML.
Introduction to Hidden Markov Modelling- Application of HMM: making a digit recognition system -Automatic segmentation and labelling of speech based on HMM- speaker verification systems – speaker identification Systems - ANN,CNN, ANN and CNN for Automatic speech and speaker recognition- Introduction to Text to speech and Speech to text, Introduction of AI and ML based applications in speech domain.

Text Books

1. Biing-Hwang Juang, Lawrence Rabiner, B. Yegnanarayana, "Fundamentals of Speech Recognition" Pearson Education, 1st Edition 2008.
2. Lawrence Rabiner, Ronald Schafer,"Theory and Applications of Digital Speech Processing," Pearson Education, 2011.
3. Thomas parsons, “voice and speech processing”, Mcgraw hill series . 1987.
4. T.F.Quatieri, "Discrete time speech signal processing, Prentice Hall,2007.

References Books

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons.
3. Papamichalis P.E., "Practical Approaches to Speech Coding", Texas Instruments, Prentice Hall,2003.
4. Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000
5. Dong Yu, Lie deng "Automatic speech recognition a deep learning approach, Springer 2014.

Web references

1. https://www.youtube.com/watch?v=X_JvfZiGEek
2. https://www.youtube.com/watch?v=3MjIkWxXigM
3. https://nptel.ac.in/courses/117/105/117105145/
4. https://www.youtube.com/watch?v=RBgfLvAOrss
5. https://www.youtube.com/watch?v=Xjzm7S__kBU
6. https://www.youtube.com/watch?v=gMQyGASOZO0

17EC3642 – Digital Image Processing

Course Code: 17EC3642 **L–T–P–S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Selected, as high level mathematics are used to model 2D complex systems; The principles of mathematics help solve Image Processing problems effectively.	**1,3**	**3**
CO2	Selected, to simulate algorithms for Systems using 2D methods	**1,3**	**2**
CO3	Selected, to create a problem identifier and learner, to find solutions in complex search space.	**1,3**	**2**
CO4	Selected, with simulations that can apply 2D models to solve Image processing problems.	**5**	**2**

Introduction to DIP: What is digital image processing? Applications, Fundamental steps of DIP, Components of DIP systems, Visual Perception and electromagnetic spectrum, Image Sensing and Acquisition including A Simple Image Formation Model using illumination and reflectance, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Image Operations on a Pixel Basis, Linear and Nonlinear Operations, Image transforms: 2D orthogonal and unitary transforms. Separable unitary transforms. DFT, WHT, KLT, DCT, Image Enhancement in both Spatial and Frequency domains, Basic Gray level transformation, **Image enhancement:** Histogram processing Enhancement using Arithmetic and logic operations, Spatial filtering: Smoothing and Sharpening filters, Enhancement using Frequency domain:2D DFT and inverse DFT, Basics of filtering in the frequency domain, Basic filters and their properties, Frequency domain smoothing, sharpening filters, Homomorphic filtering. **Image Degradation / Restoration** : process Noise Models: Gaussian, Rayleigh, Gamma, Exponential Uniform, Impulse, Salt and Pepper noise. Noise reduction: Spatial filtering approach: Mean, Order statistics filters Noise reduction: Frequency domain filtering approach: Band rejection, Band pass and Notch filters, Introduction to Segmentation: Detection of

discontinuities: Point detection, Line detection, Edge detection. Gradient, Laplacian Edge linking and Boundary detection: Local processing, Thresholding for segmentation.

Image Compression and colour image processing : Introduction to compression: Coding redundancy, inter pixel redundancy and Psych-visual redundancy, Image compression model. Error free compression: Huffman coding, Arithmetic coding and Bit plane coding Lossy Compression: Transform coding Colour fundamentals, colour models: RGB, CMY/CMYK, HIS, Pseudo colour image processing, Full Colour Image processing: Smoothing and Sharpening Spatial Filtering,LZW coding,JPEG.

Text Books

1 Digital Image Processing (3rd Edition) Hardcover – August 31, 2007 by Rafael C. Gonzalez, Richard E. Woods.

2 Algorithms for Image Processing and Computer Vision Paperback – December 21, 2010 by J. R. Parker.

3 García, Gloria Bueno, Oscar Deniz Suarez, José Luis Espinosa Aranda, Jesus SalidoTercero, Ismael Serrano Gracia, and Noelia VállezEnano. Learning image processing with opencv. Packt Publishing Ltd, 2015.

Web References

1 https://nptel.ac.in/courses/117105079/

2 https://nptel.ac.in/courses/106105032/

3 https://nptel.ac.in/courses/117104069/

BIO-MEDICAL IMAGE PROCESSING

Course Code : 17EC3643 **L–T–P–S :** 3-0-0-0

Pre Requisite: 17EC2205 **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	Understand What is Biomedical Imaging ? and its Importance ,Concepts of Image formation and Analysis are covered	**1,3**	**3**
2	Understand the Fundamentals of image formation and Major imaging modalities	**1,3**	**2**
3	Understand the Image reconstruction and feature extraction.	**1,3**	**2**
4	Understand the Application and its principles of the interpretation	**5**	**2**

Syllabus:

Introduction to Biomedical Imaging: Basic definitions (biomedical imaging, body planes, structural and an atomicalimaging), Physics concepts (e.g. wave equations, energy transport, chromophores and contrasts), Image formation and reconstruction, and levels of analysis, The temporal-spatial-signal matrix, Examples of imaging systems.

Image formation and acquisition principles: Fundamental models of image formation, The imaging system, Image quality and uncertainties in image formation (digitization, quantum efficiency, metamerism, calibration, CNR, SNR), Major imaging modalities: Magnetic Resonance Imaging, Optical Imaging (inc. X-Ray, OCT, NIRS, microscopy, confocal imaging, one and two photon imaging, fluoroscopy, CT), Electrical and magnetic imaging (inc. EEG/MEG, EMG, ECG, etc), Ultrasound.

Image reconstruction: Inverse problem and the Jacobian, Regularization, Image processing and analysis, Registration, Feature extraction; edge detection, Hough transform, Filtering; Noise removal and signal enhancement, Segmentation, Domain transformation; Fourier and Wavelets.

Image interpretation: Data mining, Advanced topics on Neuroimaging, Neuroimages (EEG, fNIRS, fMRI, PET/SPECT), Analysis and Interpretation Models: Ultrasound image enhancement (De-Noising). MRI image segmentation. Compare the medical images and their contents. Use Various image processing models on medical images for content extraction and their success and failure analysis.**Case Study:** Use of IBM Watson in medical diagnostics. Design a model for miming medical image contents to diagnose a disease (Cancer, Diabetic retinopathy, liver disfunction) in real time.

Textbook:

1. Introduction to Biomedical Imaging, Andrew G. Webb. December 2002, Wiley-IEEE press.

References:

1. The Essential Physics of Medical Imaging (2nd Edition), J. T. Bushberg, J.A. Seibert, E.M. Leidholdt Jr., J. M. Boone. November 2001.

STATISTICAL SIGNAL PROCESSING

Course Code : 17EC3644 **L–T–P-S:** 3– 0 - 0-0
Pre Requisite: NIL **Credits:3**
Mapping of Course Outcomes (CO) to Program outcomes:

CO. No.	Course Outcome	PO	BTL
1	Understand the Random variables and random processes	**1,3**	**3**
2	Explain the estimation theory and methods of estimation criteria.	**1,3**	**2**
3	Explain and analyze the estimation of signal and spectral analysis	**1,3**	**2**
4	Explain the Kalman filters and Apply and evaluate Statistical signal processing concepts to various applications under transform domain.	**5**	**2**

Review of random variables: Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and auto covariance functions, Gaussian Process and White noise process.

Parameter Estimation Theory: Bayesian estimation, Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties.

Estimation of signal in presence of white Gaussian Noise: Linear Minimum Mean-Square Error Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter. **Spectral analysis:** Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Introduction to parametric and frequency methods.

Kalman filtering: State-space model and the optimal state estimation problem, discrete Kalman filter, extended Kalman filter using Matlab.

Text Books:

1. M. Hays: Statistical Digital Signal Processing and Modelling, John Willey and Sons, 1996.
2. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan: Statistical Signal Processing with Applications, PHI, 1996.

COMMUNICATION & WIRELESS

Information Theory & Coding

Course Code: 17EC3651 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts of coding methodology	**1,2**	**3**
CO2	Understand and evaluate different communication channels.	**1,2**	**2**
CO3	Analysis of various coding techniques	**1,3**	**2**
CO4	Analysis of various Error detection and correcting methods	**1,3**	**2**

Syllabus:

Introduction: Information theory, measure, entropy, mark-off, statistical model, Shannon's Theorem: Introduction to Random Variables, Stationary Process, Mean, Correlation and Covariance Functions, Ergodic Process, Transmission of Random variable through LTI System, Power Spectral Density, Gaussian Process, Noise, Narrowband noise and its Representation, Fundamental limits in Information theory: Uncertainty, Information and Entropy, Source coding theorem, Data compression, Mutual information, Channel Coding theorem, Differential entropy and Mutual Information for Continuous ensembles, Information Capacity theorem and its implications, Information capacity theorem of colored noise, Rate distribution theory. Measure of Information, Mark-off Statistical Model for Information Sources, and Shannon-theorem.

Encoding: Shannon Algorithms, Channels, Source/Huffman coding, Error Detection & Correction: Shannon's Noiseless Coding Theorem, Fano Coding, Huffman Coding, Arithmetic coding, Basics of Error detection & Corrections, Channels: Symmetric Lossless, Deterministic, Useless, Binary Symmetric (BSE), Binary Erase (BEC), Cascade and non-symmetric channels.

Error Detection and Correction Types, Linear/Block codes, Matrix, Array, Table Look-up, Cyclic Code, BCH, RS, Olay: Introduction, Linear Block Codes, Binary cyclic Codes, Burst Error Correcting Codes, Convolution Codes, Performance of Block Codes-Error Correction and Error Detection, Hamming Code.

Miscellaneous: Error Types, Bust/Random Error corr. Codes, Convolution Codes, Impulse Response, Trellis, time-domain/Transform approach, Tree representation., State representation, State-diagrams: Error Correcting Codes, Cycle Codes, Burst Correction Codes, Convolution Codes, Trellis, time-domain/Transform approach, Tree representation., State representation, State-diagrams: (10Hrs)

Text Books

1 Communication Systems, Simon Haykin, Fourth Edition
2 Digital And Analog Communications, K.Sam Shanmugam,

Reference Text Books

1 Elements of Information theory, Thomas M.Cover, Joy A.Thomas, Second edition

2 Entropy and Information theory, Robert M. Gray, First Edition.

Web References

1 Fundamentals of Information Theory, Roberto Togneri, Christopher J.S.deSilva

4G Wireless Technologies and Cellular Communication

Course Code: 17EC3652 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO.No	Course Outcome	PO	BTL
1	Spreading Sequences and Multi user systems	**1,2**	**3**
2	Multi carrier Communication Systems	**1,2**	**2**
3	MIMO systems – spatial multiplexing. Ultra Wideband Communications	**1,2**	**2**
4	Advanced cellular communications and Miscellaneous topics	**1,2**	**2**

Syllabus:

Spreading Sequences and Multi user systems: Properties of spreading sequences, PN sequences, Gold Sequences and Walsh Sequences. Orthogonal variable spreading factor sequences (OVSF). Introduction to CDMA, DSCDMA, Multiuser detection, DSSS Techniques, FHSS verses DSSS

Multi carrier Communication Systems: Introduction to multiuser modulations, Principal of OFDM(Block Diagram), Cyclic Prefix, Introduction to long term evaluation(LTE-5E), Transceivers, Channel estimation, OFDM issues, Peak to Average Power ratio (PAPR), Carrier frequency Offset (CFO), Synchronization, PAPR reduction techniques, Multicarrier and Multi-access Systems- OFDMA, MCCDMA.

MIMO systems – spatial multiplexing. Ultra Wideband Communications: Channel Models, VBAST Architecture, Channel Modeling, SIMO, MISO, MIMO fading channels-MIMO diversity-Almouty, Orthogonal space time block code, OSTBC- MIMO-SSC, MIMO-OFDM, Introduction to features of UWB technology- applications, UWB indoor channel, UWB Capacity, Pulsed UWB, Pulse shape, Modulation and Multiple access of Pulse UWB, Time Hopping, DSUWB.

Advanced cellular communications and Miscellaneous topics: Study of 60 Hz cellular systems, Cellular fixed stations, Cellular systems in rural service areas, Diversity media systems with millimeter wave and Optical wave link and Cellular radio telecommunications systems, Cell Handoff, Cellular switching-Analog and Digital, Call routing-Special features of handling traffic. Challenges for Pulsed UWB systems- Multiband UWB-Modulation of Pulsed Multiband UWB, Multiband OFDM UWB, Introduction to 5G.

Text Books

1 Wireless Communication Systems, KE-Lin DU and M.N.Swamy

2 Fundamentals of Wireless communication, David TSE and Promod Viswanadhan

Reference Text Books

1 Mobile cellular Telecommunications, William C.Y.Lee, TMH Publications 2006

Web References

1 Advanced Wireless communications 4G Technologies, SAVO Glisic,

Optical Communication Networks

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Course Code: 17EC3654 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits:3**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Understand the basic concepts of optical communication	**1,2**	**3**
2	Analyze different optical sources, materials and structures	**1,2**	**2**
3	Evaluate different optical network protocols	**1,2**	**2**
4	Understand different optical networks	**1,2**	**2**

Syllabus:

Overview of Optical Communication: Applications, Optical Fiber Waveguide, Types, Modes: : Optical Fiber Communication system, optical fiber waveguides, types of fibers, cutoff wave length, **:** Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

Optical Sources & Sensors: LED, ILD, Laser Diodes, Power-Bandwidth, Materials, Structures: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Photo diodes , Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers, Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links.

Optical Networks and Protocols: Node, Switching Element, WDM NW, PSTN, Transport Layer: . Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, WDM standards, Interferometer, multiplexer, Isolators and circulators, active optical components, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

Misc.: Optical Switching, Wavelength Routing, Optical NWs, EDFA, SONET, SDH, OTDR, FTDX: Optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides. OTDR, FTTX networks, digital cross connects.

Text Books

1 Optical Communications Essentials, Keiser G
2 Optical Communications Rules and Thumb, John Miller, Ed Friedman,

Reference Text Book

1 Mathematical Principals of Optical Fiber Communications, J.K. Shaw,

DATA COMMUNICATION & NETWORKS
TCP/IP PROTOCOL SUITE

Course Code: 17EC3661 **L-T-P-S: 3-0-0-0**
Pre-requisite: 17EC3661 **Credits:3**
Mapping of Course Outcomes (CO) to Program outcomes:

CO No.	Course Outcomes	PO	BTL
1	Understand OSI and TCP/IP models	**1,2**	**3**

2	Study of MAC layer protocols and LAN technologies	**1,2**	**2**
3	Implement routing and congestion control algorithms	**1,2**	**2**
4	Understand application layer concepts	**1,2**	**2**

The Internet Address Architecture, Link Layer, ARP: Address Resolution Protocol, The Internet Protocol (IP), System Configuration: DHCP and Auto configuration, Firewalls and Network Address Translation (NAT), ICMPv4 and ICMPv6: Internet Control Message Protocol, Broadcasting and Local Multicasting (IGMP and MLD), User Datagram Protocol (UDP) and IP Fragmentation, Name Resolution and the Domain Name System (DNS), TCP: The Transmission Control Protocol, TCP Connection Management, TCP Timeout and Retransmission, TCP Data Flow and Window Management, TCP Congestion Control, TCP Keepalive, Security: EAP, IPsec, TLS, DNSSEC, and DKIM, Case Study: Simulation Of Network
Protocols Using NS.

Text Books :

1. Richard Stevens W, "TCP/IP Illustrated Volume 1", 2nd Edition, Prentice Hall of India/ Pearson Education, New Delhi, (2014).
2. Douglas E Comer, "Internetworking with TCP/IP- Volume I", Prentice Hall of India/ Pearson Education, New Delhi, Fourth Edition,(2002).

Reference Books:

1. Washburn K and Evans J, "TCP/IP", Addison Wesley, USA, Second Edition, (2003).
2. Behrouz A Forouzan, "Local Area Networks", Tata McGraw Hill Publishing Company, New Delhi, (2002).

VOIP Systems & Broad Band Networks

Course Code :17EC3662 **L – T – P – S :3-0-0-0**
Pre-requisite: NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	CO	PO	BTL
1	Concepts of land line telephony switching and SS7 signaling	**1,2**	**3**
2	Understanding concepts of IP networks, Protocols and L2, L3 and L4	**1,2**	**2**
3	VOIP architecture and Protocols in detail	**1,2**	**2**
4	Understanding SIP protocol in detail and Understand QOS issues in VOIP	**1,2**	**2**

Classical Telephony: Line Side/Trunk Side switching, Isochronous Transport, PSTN Signaling ,PCM, digital channel & bandwidth constraints,SS7,Services.
IP Networking Review (simple): Protocol layering, encapsulation, Ethernet, QoS at layer 2, IP, UDP, TCP,IP Addressing (network, subnet, NAT),IP Routing (RIP, OSPF).
Overview of VoIP Architectures and Protocols: Peer protocols (SIP, H323): signaling, call routing, Master-slave protocols (MGCP/Megaco et.al.): signaling, call routing, SS7 Transport (SIP-T), RTP and Codecs, RTP and RTCP: real time traffic over ip (rfc 1789), Codecs (compression, bandwidth, quality), Waveform codecs (G711, G726), CLEP codecs (G729, G723, etc.), Bandwidth control (VAD, dynamic packing, etc.).

SIP: Signaling Protocol Components (RFC 3261),SIP language elements, call flows,, Network routing: Proxies, Servers, Services, Advanced Routing, Presence/Chat, SIMPLE, ENUM, DNS, Firewalls, NATand STUN. Network QoS and QoS Mechanisms (DFWQ, MPLS)

Text Book:

1. Internet Communications Using SIP, Henry Sinnreich and Alan Johnston, Willey (second edition 2006).
2. IP Telephony, Oliver Hersent, Jean-Pierre Petit, and David Gurle, Wiley (2005).

References:

1. Johnston, A. (2015). SIP: Understanding the Session Initiation Protocol, Fourth Edition. (ISBN: 1608078639). Chappell, L. (2013). Wireshark 101: Essential Skills for Network Analysis (Wireshark Solutions). (ISBN 1793939723)

5G MOBILE AND WIRELESS TECHNOLOGY & IEEE 802 Standards

Course Code: 17EC3663 **L-T-P-S:3-0-0-0**

Pre-requisite: NIL **Credits:3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO No	CO	PO	BTL
1	Introduction of 5G Technology with use cases	**1,2**	**3**
2	Understand 5G Architecture and machine type communications	**1,2**	**2**
3	Understand Millimeter wave communication challenges and 5G Radio access technologies	**1,2**	**2**
4	Understand Massive MIMO concepts and JT CoMP	**1,2**	**2**

Introduction to 5G: IoT and 5G, Global initiatives, Standardization activities. 5G use cases examples and system concept: Extreme mobile broadband, Machine-type communications Dynamic radio access network. **5G architecture**: NFV and SDN, RAN architecture, Functional architecture, LTE and 5G integration, Physical architecture, Machine-type communications, Fundamental techniques for MTC Massive MTC, Low-latency MTC. Device-to-device (D2D) communications: RRM D2D, Multi-hop D2D Multi-operator D2D. **Milli-meter wave communications**: Spectrum and regulations, Hardware technologies for mmW, Deployment scenarios, Architecture and mobility, Beam forming. 5G RAN technologies Access design principles, Multi-carrier with filtering: Non-orthogonal schemes, Dense radio access, V2X access communication. **Massive MIMO systems**: Resource allocation, transceiver algorithms, RF implementations in massive MIMO, Channel models, JT CoMP in 5G. **Relaying and wireless network coding**: Multi-flow backhauling and multi-flow relaying Interference management, mobility management, and dynamic reconfiguration in 5G. Network deployment types. Spectrum challenges in 5G, Spectrum toolbox. 5G wireless propagation channel models, Modeling requirements and scenarios, The METIS channel models

Text book:

5G Mobile and Wireless Communications Technology by AFIF OSSEIRAN, JOSE F . MONSERRAT, PATRICK MARSCH

RF, MICROWAVE & RADARS
MICROWAVE ENGINEERING

Course Code: 17EC3671 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

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Mapping of Course Outcomes (CO) to Student outcomes:

CO. No	Course Outcome	PO	BTL
1	Able to Differentiate different Microwave components	1,2	3
2	Able to Identify transformers and microwave resonators	1,2	2
3	Understand the concept of design of different microwave filters	1,2	2
4	Analyse the applications of microwave and millimetric wave circuits	2,3	2

Syllabus:

Microwave devices: Introduction to microwave Components, Reflex klystron, TWT, phase shifters, Microwave bends, E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.

Transformers & Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators, Obstacles in waveguides-Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures.

Filters and periodic structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures.

Millimetre wave circuits: Wave Propagation in microstrip lines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers, Microwave and Millimetre Wave Integrated Circuits.

Text Books:

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", McGraw-Hill.
2. Robert E Collin, "Foundation for Microwave Engineering", McGraw-Hill.

Reference Books:

1. "Analysis Methods for RF, Microwave, and Millimetre-Wave Planar Transmission Line Structures", by Cam Nguyun.

Antenna Design & Wave Propagation

Course Code :17EC3672 **L–T–P–S: 3-0-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co. No.	Course Outcome's	PO	BTL
1	Able to identify the radiation fields and antenna fundamentals	1,2	3
2	Able to Identify different types of antennas and arrays	1,2	2
3	Understand the concept of antenna measurements, design and testing	1,2	2
4	Study of real-world applications of various antennas	5	1

Syllabus:

Radiation concept and antenna fundamentals: Concept of Vector Potential, Radiation of Small Current Element, Radiation of Short Dipole, Radiation from Half-Wave Dipole and its Radiation Resistance & Quarter-Wave Monopole, Antenna Parameters like Radiation Patterns, Directivity, Gain, Radiation Resistance, Polarization, Effective Length and Effective Area and Antenna efficiency.

Antenna types and Arrays: Log periodic antenna, Reflector antenna, Lens Antenna, Horn antenna. Two Element Arrays, N- Element Linear Arrays – BSA, EFA, Directivity N-Element Linear Array with Uniform Spacing, Non-Uniform Amplitudes, Binomial Arrays, Principle of Pattern Multiplication.

Real world applications of Antennas: Antenna design for mobile applications

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Antenna Measurement and testing: Introduction, Impedance/VSWR measurements, scattering parameters Types of Ranges: Anechoic Chamber, Elevated Ranges, Slant Range Ground Ranges, Near Field Ranges, CATR, Radiation Pattern Measurements, Gain Measurements

Antenna design for vehicular applications, Antenna design for satellite applications.

Text Books

1 C.A Balanis, "Antenna Theory", John Wiley & Sons, 2nd ed.

2 E.C. Jordan and K.G. Balamain, "Electromagnetic Waves and Radiating Systems". 2nd ed., Pearson

3 John D Kraus, "Antennas". 2nd ed., Mc Graw-Hill

4 S. Chandran, Adaptive antenna arrays, trends and applications, Springer, 2009.

Reference Books

1 3. Evans, Gray E," Antenna Measurements Techniques", Artech House, Inc

2 4. J S Hollis, T J Lyon, L Clayton," Microwave Antenna Measurements, Scientific Atlants, Inc

Radar Engineering & Navigational Aids

Course Code :17EC3673 **L–T–P–S: 3-0-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co. No.	Course Outcome's	PO	BTL
1	Understand the essential principles of operation and design of simple radar systems and analysis of essential elements of Transmitters , Receivers and design of simple Radar Receiver	1	2
2	Understand various types of Radars	1,2	3
3	Understand the principles of various Radars systems used in different applications	3	1
4	Understand the basic concepts related to different systems and sensors for navigation.	3	1

Syllabus:

Basics of Radar system, Transmitters and Receivers: Basic Radar, Block Diagram of Pulse Radar, Radar equation Detection of signals in noise, Receiver noise and signal to noise ratio, integration of Radar pulses, PRF and Range Ambiguities, Doppler Effect, FM CW Radar, Altimeter, Radome. **Transmitter and Receivers**: RF Power Sources. The Radar Receivers, Receiver Noise Figure, Duplexers and Receiver Protectors, Radar Displays.

Radar types: MTI Radar: Introduction, Delay line cancellers, Clutter Attenuation
MTI improvement factor, N-pulse delay line canceller, Non recursive and Recursive filters.
Tracking: Sequential Lobing Radar, Conical Scan and Monopulse acquisition and tracking, Radars for Air Traffic Control applications.
Radar Applications:, SAR, LIDAR, OTH radar, Remote sensing radar, Airport surveillance radar, Weather / Meteorological radar, Ground penetration radar, Through-wall radar, Automobile radar.
Introduction to Navigational Aids and Various Systems: Introduction, Four Methods of Navigation **Radio Ranges:** LF/MF Four course Radio Range, VHF Omni Directional Range, and VOR receiving Equipment. LORAN, DECCA navigation systems. Instrument Landing

System, Ground controlled Approach System, Microwave landing system, TACAN Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, and Track stabilization.

Text Books

1 Merrill I Skolnik, "Introduction to Radar Systems", 3rd Edition, TMH, (2003)
2 William L. Melvin, James A. Scheer, "Principles of Modern Radar", SciTech Publishing.
3 Elements of Electronic Navigation Systems", Tata McGraw-Hill,

Reference Books

1 Peyton Z Peebles Jr, "Radar Principles", John Wiley Inc., (2004).
2 Donald R Wehner, "High Resolution Radar", Artchtech house.
3 Radar Systems and Radio Aids to Navigation, Sen & Bhattacharya, Khanna publishers
4 J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004.

DATA-COMPUTING & APPLICATION TOOLS
MACHINE LEARNING

Course Code :17EC3681 **L–T–P–S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co. No.	Course Outcome's	PO	BTL
1	Understand the Basic Idea of Machine Learning, and its Goals	2	3
2	Understand the Parameters to Learn the Data and Explanation to Supervised Learning models	2,3	2
3	Understand the concepts of Unsupervised and semi-supervised Learning	2	2
4	To establish the theory necessary to understand the Models and Applications of Machine learning to perception.	2	2

Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

Machine Learning Perception: Learning from data, Overfitting, regularization, cross-validation **Supervised Learning:** Nearest Neighbour, Naive Bayes, Logistic Regression, Support Vector Machines, Neural Networks, Decision Trees.

Unsupervised & Semi-Supervised Learning: Clustering (K-means, GMMS), Factor Analysis (PCA, LDA), **Learning Theory:** Bias and Variance, Probably Approximately Correct (PAC) Learning.

Structured Models: Bayesian Network, Hidden Markov Models, Reinforcement Learning, Applications of ML to Perception: Computer Vision, Natural Language Processing, Design and implementation Machine Learning Algorithms, Feedforward Networks for Classification, Convolutional Neural Network based Recognition using Keras, Tensorflow and OpenCV.

Simulation: Use VGG Net and AlexNet pre-trained models for face recognition and human pose estimation problems.

Text Books:

1. Mitchell, Tom. *Machine Learning*. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
2. MacKay, David. *Information Theory, Inference, and Learning Algorithms*. Cambridge, UK: Cambridge University Press, 2003. ISBN: 9780521642989.

Reference Books::

1. Bishop, Christopher. *Neural Networks for Pattern Recognition*. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.

2. Duda, Richard, Peter Hart, and David Stork. *Pattern Classification*. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
3. Hastie, T., R. Tibshirani, and J. H. Friedman. *The Elements of Statistical Learning: Data mining, Inference and Prediction*. New York, NY: Springer, 2001. ISBN: 9780387952840.

Journals:

1. IEEE Transactions on Evolutionary Computation.
2. IEEE Transactions on Pattern Analysis and Machine Intelligence.
3. Machine Vision and Applications, Springer.

Data Science & Big Data

Course Code :17EC3682 **L–T–P–S : 3-0-0-0**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	To understand the concepts of data Science & statistics	2	3
2	To explain Inferential Big Data	2,3	2
3	To identify Big Data Streaming	2	2
4	To apply Real time Analytics Platform	2	2

Syllabus:

Basics of Data Science & Statistics: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Sampling distributions, Test of Hypothesis- Testing for Attributes-Mean of Normal Population, Analysis of variance ANOVA, Tabular data- Power and the computation of sample size- Advanced data handling- Multiple regression- Linear models- Logistic regression- Rates and Poisson regression- Nonlinear curve fitting.

Inferential Big Data: Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream-Filtering Streams-Counting Distinct Elements in a Stream- Flat Forms-Big Data Storage-Large Scale Data Storage- Analysis.

Big Data Streaming & Analysis: Estimating Moments-Decaying Window – Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming-Developing a Map Reduce Application- Anatomy of a Map Reduce Job Run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features - Hadoop environment, R, Flat Form for Past Data, Analysis.

Applications & Case Studies: Real time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions - Applications on Big Data Using Pig and Hive - Visual data analysis applications- Other applications to real world, smart cities.

Text Books

1 Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

2 Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

Reference Books

1 Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2 Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3 Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.

Web References

1 https://medium.com/ml-research-lab/how-to-self-learn-statistics-of-data-science-c05db1f7cfc3
2 https://nptel.ac.in/courses/110106064/
3 https://www.techopedia.com/definition/31752/big-data-streaming
4 https://onlinecourses-archive.nptel.ac.in/noc19_cs33/preview

VIDEO SURVEILLANCE

Course Code :17EC3685 **L–T–P–S : 3-0-0-0**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	Understanding of the fundamental concepts related to Video Surveillance.	2	3
2	Understanding of the feature extraction, pattern analysis visual geometric modelling.	2	2
3	Vehicle Tracking and Recognition, Human activity recognition	2,3	2
4	Applications range from Attribute-based people search, Age estimation from face, Gender recognition from face and body	2,3	2

Fundamentals: Image feature extraction: Feature point detection, Scale Invariant Feature Transform, Edge Detection, Color features. Multiple View Geometry: Perspective Projection Camera Model, Epipolar Geometry, Probabilistic inference, Pattern recognition and Machine learning: SVM and AdaBoost. Background Modelling and Subtraction: Kernel Density Approximation, Background Modelling and Subtraction Algorithms.

Detection and Tracking: Pedestrian Detection and Tracking: Pedestrian detection by boosting local shape features: Tree learning algorithms, Edgelet features. Occluded pedestrian detection by part combination. Pedestrian tracking by Associating Detection Responses. Vehicle Tracking and Recognition: Joint tracking and Recognition framework, Joint appearance-motion generative model, Inference algorithm for joint tracking and recognition. Human Motion Tracking: Image feature representation, Dimension reduction and Movement dynamics learning.

Activity Recognition and Camera Networks: Human action recognition: Discriminative Gaussian Process dynamic model. Human Interaction recognition: Learning human activity, Track-body Synergy framework; Multi-camera calibration and global trajectory fusion: Non-overlapping and overlapping cameras.

Systems and Applications: Attribute-based people search, Soft biometrics for video surveillance: Age estimation from face, Gender recognition from face and body, Detection and tracking of Moving Objects.

Text Books:

1. Yunqian Ma, Gang Qian, "Intelligent Video Surveillance: Systems and Technology", CRC Press (Taylor & Francis Group), 2010.

2. Fredrik Nilsson, Communications Axis, "Intelligent Network Video: Understanding Modern Video Surveillance Systems", CRC Press (Taylor & Francis Group), 2008.

Reference Books:

1. Anthony C. Caputo, "Digital Video Surveillance and Security", Butterworth-Heinemann, 1st Ed., 2010.
2. Herman Kruegle, "CCTV Surveillance, Second Edition: Video Practices and Technology" Butterworth-Heinemann, 2nd Ed., 2006.

INSTRUMENTATION & BIO-MEDICAL ELECTRONICS

AUTONAMOUS VEHICLES &AVIONICS

Course Code :17EC3691 **L–T–P–S : 3-0-0-0**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	Understand the fundamentals of comprehensive knowledge on automotive electronics.	2	2
2	Explore and conjugate the emerging technologies utilized to assist the Autonomous Vehicles.	1,2	2
3	Communication and Navigation of automated vehicle using vehicle intelligence.	2,3	2
4	Acquire the basic knowledge on aviation technology.	1,2	2

Syllabus:

Introduction to Automotive Engineering: Control systems, Vehicle component nomenclature, sensors and instrumentation, introduction to avionics. • Automotive Electronics: Different types of vehicle parameters, basic construction detail ofengine, transmission and suspension systems, Engine Electronics, Transmission Electronics, Infotainment system, Electronic integrated cockpit system, Electronic Ignition system, lighting and accessory system, Electrical Instrumentation, Electronic Throttle control system. • Sensors: Engine speed sensor, Atmospheric pressure and air temperature sensor, Steering system and steering wheel sensor, Oxygen sensor, MAP sensor, MAF sensor, Crankshaft and Cam Shaft position sensor, Coolant temperature sensor, safety sensors.

Automated Vehicle Assisting systems: Active Safety System, Passive Safety System, ADAS, Functional Safety. • Active Safety Systems: Anti Lock Braking System, Traction Control System, Electronic Stability Control ESC, Brake assist. • Passive Safety Systems: Airbag systems, Seat Belt, Occupant Safety System, Child Safety System, Pedestrian Air Bag System. • Advanced Driver Assistance Systems (ADAS): Adaptive Cruise Control ACC, Adaptive Light Control ALC, Blind Spot Monitor, Collision Avoid Monitor, Driver Monitoring System DMS, Lane Change Assistance, Pedestrian Protection system, Tire Pressure monitoring, Traffic Sign Recognition, wrong way driving warning, Automatic Parking system, Hill Decent Control. • Functional Safety: Need for safety systems, Crash Worthiness, Crash Avoidance system.

Autonomous Vehicles Technologies: Remote Sensing and Wireless Technology, Automated Vehicle Technology, Vehicle Intelligence. • Remote Sensing and Wireless Technology: Radar and Sonar, Lidar- Multiple Beam, Camera and Night Vision, Wireless System, Integration of GPS technology. • Automated Vehicle Technology: Driverless Vehicle Technology, Navigation System, V2V, V2R, V2I communication, AI and ML. • Vehicle Intelligence: Advance Drive Assistance system, ACC, LAS, SAS, Satellite communication and Telematics.

• Communication protocol: Overview of automotive communication protocols, CAN, LIN, Interfacing with infotainment gadgets.

Avionics: Introduction, Construction and Working and Indication System. • Introduction: Construction of aircraft, UAV, RPV. • Flight control systems: Airspeed Indicator, Attitude Indicator, Compass system, Gyroscopic system, Heading indicator, Turning indicator, Flight director systems, Navigation systems, Auto Pilot System, Very-High Frequency Omnidirectional Range (VOR), Non-directional Radio Beacon (NDB).

Text Books

1 Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.
2 Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

Reference Books

1 Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999
2 James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
3 Slater J.M., Donnel C.F.O, Onertial Navigation analysis and design, McGraw Hill, New York, 1964.
4 Myron Kyton, Walfred Fried, Avionics Navigation systems, 2nd edition, John Willy & Sons, 1997.
5 Albert D Helfrick, Modern Aviation Electronics: 2nd Ed., PHI, 1994.
6 John S. Duncan, "Pilots handbook of Aeronautical Knowledge", federal Aviation administration.
7 Jack Erjavec, "A systems Approach to Automotive Technology", Cengage learning India Pvt. Ltd.
8 William H Crouse, "Automotive Mechanics", 10th edition, Mc Graw Hill.
9 Dr. Kripal Singh, "Automobile Engineering", Vol.1&2, Standard Publishers

Web references

1 https://www.autonomousvehicletech.com/events/category/66
2 https://www.dspace.com/en/ltd/home/medien/videos/webinarrecords/webinarrec_sensorsim.cfm
3 https://www.mcca.com/wp-content/uploads/2018/04/Autonomous-Vehicles.pdf
4 https://www.youtube.com/watch?v=1lUkyCYdAEY
5 https://www.youtube.com/watch?v=tiwVMrTLUWg
6 https://www.youtube.com/watch?v=OlLFK8oSNEM

Biological & Cyber-Physical Systems

Course Code :17EC3693 **L–T–P–S : 3-0-0-0**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

Co.No.	Course Outcome's	PO	BTL
1	Understanding the basic parameters of Cyber-Physical systems.	2	3
2	Explore various types of Cyber-Physical systems.	1,2	2
3	Interfacing of Biology with Silicon technology.	2,3	2
4	Interpreting Various Advanced technology with some case studies.	1,2	2

Syllabus:

Introduction to Cyber-Physical Systems: Definition, Electro-mechanical smart system: GPS chips, light sensors, proximity sensors, IT/Internet/Wifi enabled hardware based systems: WiFi, 4G, EDGE, Bluetooth, Major constituents, Microcontroller boards: Arduino, RaspberryPi.

Various Types of Cyber-Physical Systems. (i) IOT Application: The Open Web Application Security Project's (OWASP).(ii) Utilization-wise categorization: Home, Industry, Security, Defence, Space etc (iii) Role-wise categorization: repair-purpose, assistive, creative, human-capacity enhancement/replacement.

Biological and Silicon Interfaces: Artificial neural networks: Biological neural networks, model of an artificial neuron, Activation functions, architectures, characteristics learning methods, brief history of ANN, ANN architectures. Biologically inspired artificial devices: Prosthetic limbs, Artificial Heart and circulatory assist devices, artificial lungs, artificial muscle. Challenges and issues Artificial vision: Computer vision – word recognition, feature extraction based on biological visual system, stereo vision; speech recognition.

Misc. Topics and case studies: Unmanned Aerial Vehicle (UAV): Why UAV, Case study: Current UAV , MQ-1 Predator, RQ-2B Pioneer, RQ-4 Global Hawk, Remotely Piloted Vehicles(RPV): Case study-FALCON from DRDO, Unmanned Marine Vehicle(UMV): Future direction, Comparison with UGV .

Text Books

1 Dynamical Model in Biology; Author: M Farkas; Publisher: Academic Press.
2 Biorobotics; Author: B Webb, T R Consi; Publisher: AAAI Press
3 Insectronics ; Author: Karl Williams; Publisher: Mc Graw Hill.
4 Amphoibionics: Built Your own biologically Inspired Reptilian Robot; Author: Karl Williams; Publisher: Mc Graw Hill.

Reference Books

1 R. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India, New Delhi, 2003

Technical Skilling-1 (Lab View and MultiSim)

Course Code :17TS401 **L–T–P–S : 0-0-0-6**
Pre Requisite: NIL **Credits : 1.5**
Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Introduction to GSD and Lab VIEW Environment such as Front Panel, Controls Palette, Controls and Indicators, Block Diagram Terminals, Functions Palette, Data Type, Boolean Operations, String Operations.	**1**	**1**
CO2	Introduction to Loop Concept, Nested Loop, Feedback, Arrays, Cluster, Plotting Data using chart and Graph, Tunnel Concept, Introduction to parallelism, Local Variable, Global Variable, Property Nodes, Invoke Nodes using Lab VIEW	**1,2**	**2**
CO3	Introduction to Case structures, Case Control using	**1,2**	**2**

	Enumerated data type, Introduction to Flat Sequence, Create New Sub VI, Input and Output Sub VI Connectors, Error handling and Debugging Techniques, Introduction to File I/O operations, Event Structure and operations, Design Technique, Introduction to Architecture, Synchronization and Communication using Lab VIEW.		
CO4	Simulation Using MultiSim Instruments such as Multimeter, Function Generator, Wattmeter, Bode plotter, Introduction to Measurement Probe and Current Probe in MultiSim, Operations on Simulation Analysis such as AC analysis, DC operating Point, Fourier Analysis, Noise Analysis, Distortion Analysis, Parameter Sweep, Transfer Function, Worst case Execution using MultiSim	**1,2**	**2**

Gist: Introduction to LabVIEW, LabVIEW environment, Graphical programming using LabVIEW, Structures using LabVIEW, Multisim.

Syllabus:

Introduction To LabVIEW: Introduction to graphical system design (GSD), working on GSD platform, Benefits of GSD, Text based programming Vs LabVIEW, Introduction to LabVIEW Environment, Front Panel Window Toolbar, Block Diagram Window Toolbar, Introduction to VIs, Data types, Data Representation, Coercion dot, Selecting a Tool, Shortcut Keys, Basic debugging techniques, Introduction to Digital Electronics, Boolean operations , Digital Circuit design, string operations, Various Display Types (Normal, code, Password, HEX display), Exploring string functions

Graphical Programming using LabVIEW: Introduction to loop concept, Type of Loops, For loop, Nested For loop, While loop(Stop if true and Continue if True), hybrid nested loop, Feedback Node, Shift Register and Stack Shift register, Introduction to tunnel and its type, Auto-Indexing, Last Value, Concatenating, Introduction to Arrays, operations of Array Functions, 1-D Array, 2-D Array, Introduction to Clusters, Cluster Function, Difference between Array and Cluster, Chart, Graph, Difference between Chart and Graph by Execution Exercise, Signal Generation and Plotting, Introduction to parallelism, Local Variable, Global Variable, Property Nodes, Invoke Nodes,

Structures Using LabVIEW: Introduction to Case structures, Case Control using Enumerated data type, Enum with type definition, Introduction to Flat Sequence, Create New Sub VI from Scratch, Input and Output Sub VI Connectors, Icon Editor, Making Sub VI from existing VI, Using Sub VIs Exercises, Finding Errors, Error handling and Debugging Techniques.

File I/O: Introduction to File I/O, Reading a Data from file, Writing a Data to file, Understanding File I/O using RefNum, File I/O Function Pallet, Introduction to Event Structure and operations, Design Technique, Introduction to Architecture, State machine Architecture.

Synchronization and Communication: producer and consumer (Multiple Loops/Parallel programming), Master Slave Architecture Exercises, Difference between Producer Consumer and Master Slave Architecture.

MultiSim: Simulation Using MultiSim, Using various instruments like Multimeter, Function Generator, Oscilloscope, Wattmeter, Bode plotter, IV analyzer using MultiSim, using Measurement Probe and Current Probe in MultiSim. Introduction to Simulation Analysis Using MultiSim, AC analysis, DC operating Point, Fourier Analysis, Transient Analysis, Noise Analysis, Distortion Analysis, DC Sweep, Parameter Sweep using MultiSim.

Software Tool:

NI LabVIEW, NI MultiSim.

Text Books:

1. "Hands-On Introduction to LabVIEW for Scientist and Engineers", John Essick, OXFORD University Press, Second Edition.

2. "Circuit Analysis with MultiSim" DavidBaez-Lopez & Felix E. Guerrero- Castro, Morgan & Claypool Publisher.

Reference Books:

1."LabVIEW for Everyone", J. Travis &Jim Kring, PRENTICE Hall , Third Edition.

2."Introduction to MultiSim", Nilsson& Riedel, 9th Edition

Reference Videos:

http://www.ni.com/academic/students/learn-labview/
https://www.youtube.com/playlist?list=PLmdbvGjzIE-EOLHC-RHeUmO1W7v_YuKAX

Technical Skilling-2(Matlab) (Communications and DSP)

Course Code :17TS402 **L–T–P–S : 0-0-0-8**
Pre Requisite: NIL **Credits : 2**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the array, indexing operations in Matlab and python. Understand the Analysis of LTI Systems and Filters	**1**	**2**
CO2	Apply DFT and FFT in speech and bio-signal processing.	**2**	**2**
CO3	Explore Multi-rate Signal Processing and Apply Wavelet transform for statistical feature extraction.	**2**	**2**
CO4	Explore ANN classifier, Apply Wavelet transform, ANN for classification	**2**	**2**

Gist: Introduction to MATLAB and python, Usage of MATLAB for array indexing, scientific calculations, DFT, FFT, bio-medical signals, STFT, ANN case studies.

SYLLABUS:

MATLAB- Vector and Matrix operations and Indexing, Mathematical operations on Arrays,

Scripts and Functions, Introduction to Python, Data Frames in Python, Numerical Python (Numpy) & Array Indexing and scientific calculations, Multi-dimensional array (Matrix) indexing and operations.
Convolution and Correlation, Filtering by convolution for elementary signals, real time signals and Images. Filtering in time domain, filtering in frequency domain (Case Study).
Review of Discrete Fourier Transform (DFT) and and Fast Fourier Transform (FFT), Comparison of the computational complexity of DFT and FFT, DFT and FFT applied in audio Processing, Plotting the FFT values with normalized frequency, Cepstrum Aliasing, Introduction to Biosignal processing- ECG and EEG signal processing preliminaries, Power spectrum estimation, ECG detection algorithm for filtering, Power Spectrum Estimation of EEG with FFT.
Multirate Digital Signal Processing , Short Time Fourier Transform (STFT) , Fourier to Wavelets , Translation and Scaling, Discrete Wavelet Transform, Statistical Feature extraction, STFT applied to non- stationary (Speech) signals, Wavelet Transform - Evolution, Haar Wavelets, Daubechies wavelet, Signal and Image feature extraction with wavelet transforms (case study - MATLAB).
Artificial Neural Systems: Preliminaries, Wavelet Transform for Classification of ECG and EEG Signal using ANN (Case study MATLAB), Introduction to Convolution Neural Networks, Deep Learning (Case study Python).

TEXT BOOKS:

1. John G Proakis, Dimtris G Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Pearson Education.
2. Alan V Oppenherim, Ronald W Schafer, John R Back, Discrete Time Signal Processing, Pearson Education, 2nd Edition.

REFERENCE BOOKS:

1. Matlab - An Introduction with Applications- Amos Gilat , V Edition, Wiley, 2010.
2. Getting Started with MATLAB, Rudra Pratap, VII edition, 2006.
3. Audio and Speech Processing with MATLAB, Paul Hill, CRC Press, 2019
4. P.P. Vidyanathan, “MultirateMultirate systems and filter banks,”Pearson (1993).
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems" Jaico Publishing House, 2004

WEB REFERNCES:

1. https://global.oup.com/academic/product/getting-started-with-matlab-9780190602062?cc=id&lang=en&#
2.https://ccrma.stanford.edu/~jos/GlobalJOSIndex.html

MOOCS:

https://in.mathworks.com/help/dsp/ref/spectrumanalyzer.html
https://www.edx.org/

Technical Skilling-3 (VLSI-Xilinx-Vivado, ES-Keil&ARM, SP-Python, CS-Tems, IOT-Python, ML&AI-Keras)

Course Code :17TS403 **L–T–P–S : 0-0-0-8**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
1	Learning the Domain based tool and understanding the real time applications	1	1
2	Understanding the tool for basic operational applications	1,2	2

3	Understanding the tool for Minor Projects (Real time applications).	1,2	2
4	Applying the domain based tool for project developments which can be used as a product	1,2	2

Syllabus :

1. Design and verify the schematic of CMOS Logic gates 2. Design and verify the schematic of CMOS Special gates 3. Design and verify the schematic Boolean Expression 4. Design and verify the layout of CMOS Logic gates 5. Design and verify the layout of CMOS Special gates 6. Design and verify the layout of SR Latch 7. Design and verify the layout of Half Adder 8. Design and verify the schematic of 1-bit SRAM cell. 9. Design and verify the layout of Ring oscillator using 5 NOT gates (or)

1. Loan Prediction Data : Predict if a loan will get approved or not. 2. Time Series Analysis Data : Specific to time series and the challenge here is to forecast traffic on a mode of transportation. 3. Heights and Weights Data: Predict the height or weight of a person. 4. Bigmart Sales Data: Predict the sales of a store. 5. ImageNet Data: object detection, localization, classification and screen parsing. (or)

1. Design and simulation of the M-ary PSK Using Matlab/Simulink for Rayleigh fading with AWGN. 2. Simulation of the power received at the receiver w.r.t to the distance for different path loss exponents. 3. Design and simulation of multipath signal reception with equalizer and without equalizer for different path delays 4. design and study the performance of SISO and SIMO using MATLAB 5. Simulation of basic OFDM 6. Performance Analysis of Various Modulation Techniques in Rayleigh and Rician Wireless Channel Models (or)

1. Sense the temperature of the living room. 2. Monitor gas leakage in building 3. Identify the humidity of remote location with the help of IoT 4. IoT based human interaction detection in a location. 5. Store the soil moisture data in cloud using IoT

Web Links :

https://www.tinkercad.com/things/6UWaknlDyk3-terrific-jaiks/editel?tenant=circuits
https://towardsdatascience.com/top-9-data-science-projects-for-a-beginner-in-2020-26eb7d42b116 https://www.elprocus.com/wireless-communication-project-ideas/
https://www.pantechsolutions.net/blog/top-100-vlsi-projects-with-source-code/

Technical Skilling-4 (VLSI-Mentor Graphics, ES-Python& RasberriPie, SP-Python, CS-BTS simulators, IOT-Open CV, ML&AI-Tensor Flow)

Course Code :17TS404 **L–T–P–S : 0-0-0-8**
Pre Requisite: NIL **Credits : 3**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
1	Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create the file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre-layout simulation.	1	1
2	Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation.	1,2	2

3	Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, learning of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino	1,2	2
4	Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV, and different simulators.	1,2	2

Syllabus :

Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre layout simulation. Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation. Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, laering of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV and different simulators.

Web Links :

Text Books :

1. “Verilog HDL: A Guide to Digital Design and Synthesis, S. Palnitkar, "Prentice Hall NJ, USA), 1996.

Reference Books :

1. Verilog HDL Synthesis - A Practical Primer, “J.Bhaskar”, Star Galaxy Publishing,(Allentown, PA)",1998

Web Links :

https://www.youtube.com/watch?v=pLB65w6U7P0
https://www.youtube.com/watch?v=KNV4syS8xhQ
https://www.youtube.com/watch?v=NnSyxhk9Nas
https://www.youtube.com/watch?v=R8IUqlLA1-I
https://www.youtube.com/watch?v=NnSyxhk9Nas&t=11s
https://www.youtube.com/watch?v=vdDlHcntfXo

Technical Skilling-5 (VLSI-Pspice or Cadence, ES-CC Studio, SP-VC++, CS-HFSS-CST, ML&AI-Spider)

Course Code :17TS405 **L–T–P–S : 0-0-0-6**

Pre Requisite: NIL **Credits : 1.5**

Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	1,2,5	3
2	Express different Decision Making statements and Functions	2	2
3	Interpret Object oriented programming in Python Understand and summarize different libraries and packages	2	2
4	Explain how to use java effectively in all data types, array, functions, and search	5	3

Syllabus :

Basics of Python: Basic Theory: String-JSON-List-Dictionary-Tuple-Sets-CollectionsHeap queue algorithm. Technical Skilling Experiment: String-JSON-List-Dictionary-Tuple-SetsCollections-Heap queue algorithm (Minimum Three Programs based on math operations, Strings and List/Tuples/ Dictionaries)

Array, Functions, class, structures in Python Basic Theory: Array-Condition Statements and Loops- Functions-LambdaOperating System Services-Date Time-Class-Data Structure-Search and Sorting-Linked List-Binary Search Tree-Recursion-Math Technical Skilling Experiment: Write python programs to understand ArrayCondition Statements and Loops- Functions-Lambda-Operating System Services-Date Time-Class-Data Structure-Search and Sorting-Linked List-Binary Search Tree-Recursion-Math (Minimum Three Program)

Libraries, Packages in Python 3 Base Theory : Python GUI tkinter-tkinter Basic-tkinter widgets-Python NumPy-Python NumPy Home-Python GeoPy-Python GeoPy Home-Beautiful Soup-Beautiful Soup Home-Arrow Module-Arrow Home-Python Pandas-Python Pandas Home- Requests- pip -Scrapy- Pillow-Twisted-Numpy- SciPy- Matplotlib- Nose-SymPy-IPythonpyquery-py-amqplib- Elastic Search- Pymongo- Django- TastyPie- TensorFlow-Scikit-Learn, NumpyKeras- PyTorch- Pandas-flash Technical Skilling Experiment: Lab Experiment: Write python programs to understand Libraries, Packages in Python 3 minimum of three programs.

Practice on Java Theory : Data Types -Conditional Statement-Array-StringDate Time-Method-Numbers-File Input-Output-Collection-Math-Sorting-Search Technical Skilling Experiment: Write python programs to understand basic java data types, conditional statement, array (minimum of three programs).

Text Books :

1. Zed A. Shaw - Learn more Python 3 the hard way the next step for new Python programmers (2018, Addison-Wesley Professional)
2. David Beazley, Brian K. Jones - Python Cookbook
3. Doug Hellmann - The Python 3 Standard Library by Example (2017, Addison-Wesley Professional).
4. Walter Savitch -Java_ An Introduction to Problem Solving and Programming, Global Edition [8th].

Reference Books :

1. Python Fluent Python_ clear, concise, and effective programming (2017).
2. Python Crash Course_ A Hands-On, Project-Based Introduction to Programming, 2nd Edition .
3. Learn to Master Python, from Star EDU solutions, by Script Demics
4. Allen B. Downey - Think Python (2012, O'Reilly Media
5. D Narasimha Karumanchi data Structures and Algorithms Made Easy in JAVA Data Structures and Algorithmic Puzzles (2020).

Web Links :

1. https://www.python.org/

2. https://www.scipy.org/
3. https://go.java/

Technical Proficiency & Training -1
(C, C++, OOPS)

Course Code :17TP3101 **L–T–P–S : 0-0-0-4**
Pre Requisite: NIL **Credits : 1.5**
Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
1	Basic Building Block concepts of Programming related to Input-Output function, If-Else and Nested If-Else. And the problems related to it.	1,2	3
2	Basic Building Block concepts of Programming related to Switch Case, For loop, while loop, break, Continue,Goto, Functions and Recursions. And the problems related to it.	1,2	3
3	Basic Building Block concepts of Programming related to Arrays, Strings, Sorting and Searching. And the problems related to it.	1,2	3
4	Basic Building Block concepts of Programming related to Structures, Linked List, Queue, Stack and Greedy. And the problems related to it.	1,2	3

Syllabus :

Syllabus: Input-Output function, If-Else and Nested If-ELse: Basic Concepts related to Input and Output functions, If-Else and Nested If-Else. Problems related to Input-Output functions, If-Else and Nested If else. Loops, Functions and Recursions : Basic Concepts and Problems related to For loop, While loop, Break , Continue, Goto , Switch Case , Function and Recursion. Arrays, Strings, Sorting and Searching: Basic Concepts and Problems related to Arrays 1D and 2D, Strings, Sorting and Searching. Structures : Basic Concepts and Problems related to Structures, Linked list, Queue, Stack and Greedy.

Text Books :

1. 1. Yeswanth Kanetkar ," Let Us C" BPB Publication, 2017
2. E.Balagurusamy," Programming in ANSI C"McGraw-Hill,2019
3. Narasimha Karumanch," Data Structures and Algorithms Made Easy" Careermonk Publications,5th Editions.

Web Links :

1. www.hackerrank.com
2. www.hakerearth.com

Technical Proficiency & Training -2
(VLSI-Pspice or Cadence, ES-CC Studio, SP-VC++, CS-HFSS-CST, ML&AI-Spider)

Course Code :17TP3102 **L–T–P–S : 0-0-0-4**
Pre Requisite: NIL **Credits : 1.5**
Mapping of Course Outcomes (CO) to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
1	Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create file for schematic, create pyxis schematic, Design of a	1	1

	basic CMOS inverter using pyxis schematic, pre layout simulation.		
2	Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation.	1,2	2
3	Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, laering of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino	1,2	2
4	Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV, and different simulators.	1,2	2

Syllabus :

Introduction to Mentor Graphics tool. create a project, addition of libraries, identify path for generic13 library file, create file for schematic, create pyxis schematic, Design of a basic CMOS inverter using pyxis schematic, pre layout simulation. Introduction to layout, Initialize the circuit for layout design, design of layout for basic CMOS inverter, Introduction to Calibre, Design rule check, Layout vs Schematic, Parasitic Extraction, Post layout simulation. Introduction to Python, Raspberry implementation using Python Python, Introduction to sp python, laering of Simulators for Python, Introduction to IoT. Programs using raspberry, Arduino Introduction to Artificial Intelligence, Introduction to Machine Learning, Implementation of different Programs, Open CV and different simulators.

Text Books :

1.“Verilog HDL: A Guide to Digital Design and Synthesis, S. Palnitkar, "Prentice Hall NJ, USA), 1996.

Reference Books :

1.Verilog HDL Synthesis - A Practical Primer, “J.Bhaskar”, Star Galaxy Publishing,(Allentown, PA)",1998

Web Links :

https://www.youtube.com/watch?v=pLB65w6U7P0
https://www.youtube.com/watch?v=KNV4syS8xhQ https://www.youtube.com/watch?v=NnSyxhk9Nas
https://www.youtube.com/watch?v=R8IUqlLA1-I
https://www.youtube.com/watch?v=NnSyxhk9Nas&t=11s
https://www.youtube.com/watch?v=vdDlHcntfXo

MOOCS :
Hardware Description Languages for FPGA Design https://www.coursera.org/lecture/fpgahardwaredescription-languages/introduction-to-hardware-description-languages-for-fpga-design-JoMWp

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

OPEN ELECTIVES

IPR & PATENT LAWS

Course Code: 17 BT 40A1 **L-T-P:** 3-0-0

Prerequisite: NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	Acquire the knowledge of intellectual property rights	1	1
CO 2	Describe the principles and regulatory affairs	2	2
CO 3	Develop documentation ,Protocols and Case Studies on Patents	5	3
CO 4	Compare various Case Studies on Patents	5	3

SYLLABUS:

Intellectual Property Rights Patents and intellectual property rights (IPR): Definition, History of intellectual property; Types of intellectual property rights, copy rights, trade marks, geographical indication, Industrial design rights, patents. Sources of patent information, patent application procedures. **Principles, Scope and Functions Of GATT&WTO** GATT-Historical perspective, objectives and fundamental principles, impact on developing countries. WTO-Objectives, scope, functions, structure, status, membership and withdrawal, dispute settlement, impact on globalization, India-tasks and challenges.

Regulatory Affairs Indian contest-requirements and guidelines of GMP, understanding of Drugs and cosmetic act 1940 and rules 1945 with reference schedule M,U & Y. Related quality systems-objectives and guidelines of USFDA,WHO & ICH; Introduction to ISO series.

Documentation and Protocols Documentation: Types related to pharmaceuticals industry, protocols, harmonizing formulation development for global fillings, NDA, ANDA, CTD, Dealing with post approval changes-SUPAC, handling and maintenance including electronic documentation.**Case Studies on Patents**

Case Studies on - Patents (Basumati rice, turmeric, Neem, and related medicinal plants and byproducts)

Textbooks:

S. H. Willig, Good manufacturing practices for Pharmaceuticals, Informa Healthcare (Oct 2000).

Reference books:

Industrial Property Rights: Vol. III-4, Kogan Pate, Kogan Pate, Kogan Page (May 1998)

ENVIRONMENTAL POLLUTION CONTROL METHODS

Course Code : 17 CE 40A2 **L-T-P:** 3-0-0

Prerequisite : NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	To identify the sources of Air pollution, effects and control methods.	3	2
CO 2	To Identify the sources of water pollution, effects and control methods.	12	2
CO 3	To identify the sources of solid waste and disposal methods.	3	2
CO 4	To identify the sources of noise pollution, effects and control methods.	3	2

SYLLABUS :

Air pollution: Sources, Types, and effects and Fate of air pollutants. Meteorological factors and their impacts on pollutants dispersal. Sampling and measurement of air pollutants. Air quality standards. Air pollution control methods for particulates and gaseous pollutants. Emission Control equipments for particulate and gaseous matter. **Water pollution:** Sources, Types and Effects of Water pollutants. Measurement of pollution loads: DO, BOD, COD, TOC - Water quality and Effluent discharge standards. Role of Microorganisms in wastewater treatment. Bacterial population dynamics- growth kinetics. Pretreatment, primary treatment, secondary and tertiary treatment of wastewater. Low cost treatment unit processes. **Solid waste:** Sources and types of Solid wastes – Disposal methods: Land filling - Composting - Incineration – Pyrolysis. Reclamation of polluted and degraded soil by Bioremediation- Phyto-remediation. Human acoustics, Sound and its general features- Noise and its measurement - Noise pollution hazards -Control methods.

Text Books:

1.Environmental Pollution Control Engineering by C.S.Rao (2006), New Age International (P)

Limited Publishers, New Delhi.

2.Environmental Engineering by Howard S. Peavy, Donald R. Rowe and George Tchobanoglous(1985), Mc Graw-Hill International Editions, NewYork.

ReferenceBooks:

1. Sewage Disposal And Air pollution Engineering by S.K. Garg, Khanna publishers, New Delhi, 2010.

2. Waste water Engineering by M.N Rao and A.K Dutta, Oxford & IBH Publishing Co.Ltd, 2000.

3. Air Pollution by M.N Rao and H.V.N Rao, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000.

4. Environmental Engineering by Davis Cornvel, McGraw Hill Book Co., New York, 2000.

5. Waste Water Engineering by Met Calf &Eddy, McGraw Hill Book Co., New York, 2006.

SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Code : 17 CE 40A3 **L-T-P:** 3-0-0

Prerequisite : NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	Understand the importance types, sources and disposal methods of Solid waste Management.	3	2
CO 2	To understand the importance of conversion and recycling of waste.	3	2
CO 3	Understand the types and Sources of Hazardous waste	12	2
CO 4	Understand the disposal methods of Hazardous waste	12	2

SYLLABUS :

Solid wastes: Sources, Types, reasons for increase in generation, composition and properties of solid waste , Collection and on-site handling , Separation and processing. Solid waste disposal methods, Land filling, methods of land filling, Design of Landfills, gas production, Leachate and its control.

Conversion and recovery :Incineration, Pyrolysis, Composting methods, merits and demerits, Energy recovery, Biomethanation, use of refuse derived fuels (RDF).

Hazardous Waste, Definition, Sources, Classification, Hazardous wastes rules, and Nuclear waste, Biomedical wastes, Chemical wastes, disposal methods, Waste minimization. Treatment

methods, Physico-chemical processes, Biological methods, Stabilization and Solidification, Thermal methods, Disposal methods Land disposal. Remedial technologies.

TEXT BOOKS:

1.Solid waste Engineering by P.Aarne Vesilind , William Worrell & Debra Reinhart, Cengage Learning India Pvt. Ltd, New Delhi
2.Environmental pollution control Engineering by C. S. Rao; New age International Publishers, New Delhi.

REFERENCE BOOKS:

1.Venkatappa Rao. G and Sasidhar. R.S.(2009), Solid waste management and Engineered Landfills, Sai Master Geoenvironmental Services Pvt.Ltd, Hyderabad
2.World Health Organization, *Global Water Supply and Sanitation Assessment 2000* (Geneva2000).
3.Environment and Pollution Laws: Universal, Universal Law Publishing Co. Pvt.Ltd, Ed 2011.
4.Solid and hazardous waste management by M.N.Rao and Razia Sultana, BS Publications, Hyderabad

REMOTE SENSING AND GIS

Course Code : 17 CE 40A4 **L-T-P:** 3-0-0

Prerequisite : NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	To get the Knowledge of Remote sensing Technology.	3	2
CO 2	Strong base of knowledge to Integrate the Remote sensing and GIS	3	2
CO 3	Design of Geospatial Information systems using RS	12	2
CO 4	Design of Geospatial Information systems using GIS in solving societal problems	12	2

SYLLABUS :

Remote sensing basic definition and process, Passive and active remote sensing. Electromagnetic Spectrum, Resolution, Characteristics of Various sensors and satellites, Fundamentals of Image Processing. Map as a model, Spatial elements and terminology, Map scale, Spatial referencing system, Computers in map production, General software's in map production.Types of data products; Image interpretation strategy, Levels of interpretation keys; Topography, Types of Drainage Pattern and Texture, Erosion, ; Basic elements of image interpretation. Overview on visual image interpretation equipment. -

A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels/scales of measurement. The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing. Stages of GIS data modeling; Raster and Vector data representation, Spatial data models; Data editing, Detecting and correcting errors, Data reduction and generalization Edge matching and Rubber sheeting, Components of data quality,Sources of error in GIS.

Land use /Land cover studies, slope mapping, preparation of structures map, Ground water prospects mapping, Watershed management and Action plan, Water quality modeling, Salt Water intrusion models, pipeline alignment studies, Solid and hazardous waste disposal site selection, Landslides mapping, Urban planning and Management, GPS applications.

TEXT BOOKS:

1. Remote Sensing and Image Interpretation- 5th Edition by Lillesand, Kiefer and Chipman, Published by John Wiley and Sons, Inc, New York, 2007**2.**

2. Text book of Remote sensing and GIS – 3rd Edition by M. Anji Reddy, BS Publications, Hyderabad, 2010.

Reference Books:

1. Geoinformatics for Environmental management" by M. Anji Reddy, B.S Publications, Hyderabad

2. Remote Sensing and GIS- by B. Bhatia Published by Oxford University Press, 2009

DISASTER MANAGEMENT

Course Code : 17 CE 40A5 **L-T-P:** 3-0-0

Prerequisite : NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	Define and describe types of disasters, related hazards and the causes for disasters	12	2
CO 2	Know the effects, remedial measures, mitigation measures to be taken with respect to the kind of disaster that occur.	3	2
CO 3	To know about the disaster risk, reduction and the various organisations involved with related to disasters	3	2

CO 4	To know about the vulnerability and mitigations of various disasters with the help of case studies	3	2

SYLLABUS:

Introduction and Concept of disasters and hazards related to Earthq uakes, Tsunami, Volcanic eruption, Cyclones, Floods, Drought, Landslides, Forest fires, Avalanches and Pest infestation. Prediction and perception of hazards and adjustments to hazardous activities; Rates of natural cycles and residence time. Landslide: causes, prevention and correction. Landslide hazard mitigation. Earthquakes: intensity and magnitude of earthquakes; geographic distribution of earthquake zones; precursors to the earthquakes, seismic waves, travel-time and location of epicentre; nature of destruction; ground subsidence; protection from earthquake hazards; do's and don'ts during earthquake; Tsunamis causes and consequences. Floods: Causes, nature and frequency of flooding: nature and extent of flood hazard; urban floods, environmental effects of flooding; flood mitigation methods. Tropical cyclone- formation and consequences. Coastal erosion; sea level changes and its impact on coastal areas. Drought: Nature and effect on plant and animal systems. Study of pattern and mitigation of forest fires. Geological and environmental investigations for the construction of dams, bridges, highways and tunnels. Impact of major geotechnical projects on the environment. Disaster Management: Capability- Vulnerability- risk- preparedness and mitigation- Disaster management cycle; Disaster Risk Reduction and Resilience; Disaster Management Act and Policy. Disaster Management case studies.

Text books:

1.Environmental Hazards by Smith, K., Routledge, London,1992.
2.Geological Hazards by Bell, F.G., Routledge, London,1999.

Reference books:

1.Principles of Engineering Geology by Krynine, D.S. and Judd, W.R., CBS, New Delhi, 1998.
2.Natural Hazards by Bryant, E., Cambridge University Press. London, 1985.
3.Landslide Disaster – Assessment and Monitoring Nagarajan, R., Anmol Publications, New Delhi, 2001.
4.Environmental risks and hazards by Cutter, Susan L., Prentice Hall of India, New Delhi.1999.
5.Bill Mc Juire, Ian Mason and C. Killburn (2002) Natural hazards and Environmental change, Oxford University Press, New York.
6.Gupta, Harsh K. (2003) Disaster Management, Universities Press (India) Pvt. Ltd
7.Coppola, Damon P. (2006) Introduction to International Disaster Management, Butterworth -Heinemann
9.Jha, Madan Kumar (2010) Natural and Anthropogenic Disasters: Vulnerability, Preparedness and Mitigation, Springer
10.Glade, Thomas, Malcolm G. Anderson, Michael J. Crozier (2005) Landslide Hazard and Risk, edited Springer

11.Singh, Surendra, Leszek Starkel, Hiambok Jones Syiemlieh (2008) Environmental Changesand Geomorphic Hazards, Bookwell.

FUNDAMENTALS OF DBMS

Course Code : 17 CS 40A6 **L-T-P:** 3-0-0

Prerequisite : NIL **Credits:** 3

Mapping of Course out comes with student out comes:

CO No	Course Outcome	Mapped PO	B T L
CO 1	Understand the fundamentals of database management systems including data models, database architectures, and database manipulations and be able to model ER-diagrams.	4	2
CO 2	Understand the theories and techniques in developing database applications and be able to write queries, functions and procedures with help of SQL	2	2
CO 3	Understand the different normal forms and transaction issues and be familiar with managing database systems, new developments and trends in databases.	4	2

SYLLABUS

Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types, **Data Modeling:** ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. **SQL:** Data Definition and other languages in SQL, Creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, Embedded SQL- Writing functions and procedures with PL/SQL, Relational Model, Relational Algebra, Operators in relational algebra. **Normalization:** Guidelines for good database design, Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4^{th} and 5^{th} normal forms. File storage, Index structures, Indexing and hashing (Basics) Query Processing: Issues in query processing **Transaction Processing:** Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log, Concurrency control

techniques: binary locks**,** exclusive locks, Lock based techniques, Timestamp based techniques,.

TEXT BOOK:

1.Elmasri and Navathe, 'Fundamentals of Database Systems', 2008, 4th edition, Pearson Education. '

REFERENCE BOOKS:

1.Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts:, 2003, Fifth Edition, Tata MCGraw-Hill.

2.Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 2004, second Edition, Tata MCGraw Hill.

FUNDAMENTALS OF SOFTWARE ENGINEERING

Course Code: 17 CS 40A7 L-T-P 3-0-0

Prerequisite: Nil Credits : 3

Mapping of Course outcomes with Student outcomes

CO.NO.	Course outcome's	Mapped PO	BTL
CO1	Comprehend software development life cycle and prepare SRS document	**4**	**2**
CO2	Apply software design and development techniques, understand software process improvement	**2**	**2**
CO3	Identify verification and validation methods in a software engineering project	**4**	**2**

SYLLABUS :

Software and Software Engineering: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths. Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process. Agile development: Agility, agile process, extreme programming. Design issues : Software architecture, architectural styles, architectural design.Use cases, Classes, Relationships, common Mechanisms and their diagrams. Interfaces, Modeling techniques for Class & Object Diagrams. Behavioral Modeling :Interaction diagrams. Activity Diagrams.Software testing: A strategic approach to software testing, strategic issues, test

strategies for conventional software, Black-Box and White-Box testing, validation testing, system testing. Software Process Improvement, SPI, The SPI process, The CMMI.

Text Books:

1. Roger S.Pressman ,"Software Enginering – A Practitioner's Approach 7th Edition, Mc Graw Hill,(2010).
2. Ian Sommerville, 'Software Engineering', Sixth Edition,Pearson Education,(2001).
3. Jim Arlow, Ila Neustadt, "UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design", 2nd Edition, Pearson, (2005).

Reference Books:

1. Craig Larman, "Applying UML and Patterns: An introduction to OOAD and design and interface deployment", Pearson, (2002).
2. Alan Dix, Janet Finlay, Gregory d Abowd, Russel Bealel,"Human Computer Interaction", 3rd edition, Pearson education, (2008).
3. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,(2007).

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course Code : 17 CS 40A8 **L-T-P 3-0-0**

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course outcome	Mapped PO	BTL
CO1	Understand the architectural design of a computer and various basic concepts of operating systems and programming fundamentals	**1**	**2**
CO2	Analyze various software development methodologies and gain capability to design databases**.**	**2**	**2**
CO3	Designing various model diagrams using Unified modelling language and understand basic commands that come across in querying a database.	**2**	**2**

SYLLABUS:

Fundamentals of Computers: Introduction, Architecture, organization of a small computer, center Processing Unit, Execution cycle, Instruction categories, measures of CPU performance, Memory, Input/output devices, BUS-addressing modes. **System Software:** Assemblers, Loaders and linkers, compilers and interpreters. **Operating System:** introduction, memory

management schemes, Process management, scheduling, threads. **Programming Fundamentals:** Problem solving with algorithms, Programming styles, coding Standards and Best practices, Introduction to C Programming, Testing and Debugging. Code reviews. **System Development Methodologies:** Software development Models. **User Interface Design:** introduction, the process, Elements of UI design & reports. **RDBMS:** Introduction, Data processing, the database technology, Data models **ER Modeling:** Concept, Notations, Extended ER features, Logical database design **Normalization:** Functional Dependency, Normal Forms. **SQL:** DDL statements, DML statements, DCL statements, writing Simple queries. **SQL tuning techniques:** Embedded SQL, OLTP. **Object oriented concepts:** Object oriented programming, relationship, Inheritance, Abstract classes, polymorphism, UML Diagrams, Object Oriented Design Methodology. **Rational Rose Tool:** Application of OOC using Rational Rose Tool.

TEXT BOOKS

1. Andrew S. Tanenbaum, Structured Computer Organization,PHI,3rd ed.,1991
2. **S**iberschatz and Galvin, Operating System Concepts, 4th ed., Addision-Wesley,1995
3. Dromey R.G., How to solve it by Computers PHI,1994
4. Kernighan, Ritchie, ANSI C language PHI,1992
5. Wilbert o.Galitz essential Guide to user interface design john,wiley,1997
6. Alex Berson, Client server Architecture, McGrew Hill International,1994
7. Rojer Pressman,Softer Engineering-A Practitioners approach, McGraw Hill 5th ed., 2001
8. Alfred V Aho,E Hoproft, Jeffrey D Ullman, Design and Analysis or computer algorithms, Addison Wesley publishing Co..;1998
9. Henny F korth , Abraham Silbefrschatz, Database System concept, 2nd . McGraw- Hill international editions,1991
10. Elmasri and Navathe, Fundamentals of Database systems, 4th edition, admison Wesely, Person Eductaion

Image Processing

Course Code : 17 EC 40A9 **L-T-P 3-0-0**

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course Outcome (CO)	PO/PSO	Blooms Taxonomy (BTL)
CO1	Understand the fundamental concepts of a digital image processing system and transformation techniques	1/ 1	1,2

CO2	Analyze image enhancement techniques in spatial and frequency domains.	2,3/ 1	1,2
CO3	Explore image restoration and compression techniques.	3/1	1,2
CO4	Comprehend image segmentation, representations and description	1/1	1,2

INTRODUCTION: Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.

DIGITAL IMAGE FUNDAMENTLS: Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations,

IMAGE TRANSFORMS – The Discrete Fourier Transform, The FFT, Walsh, Hadamard, Discrete Cosine Transform, The Haar Transform, And The Slant Transform.

IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Some basic Grey transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters.

IMAGE ENHANCEMENT IN FREQUENCY DOMAIN: Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters.

IMAGE RESTORATION: Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Inverse Filtering, Wiener Filtering, Least mean square Filtering.

IMAGE COMPRESSION: Fundamentals – Image Compression models – Error Free Compression, Lossy Compression,

IMAGE SEGMENTATION: Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

IMAGE REPRESENTATIONS AND DESCRIPTION: Representation schemes, Boundary Descriptors, Regional Descriptors

TEXT BOOKS:

1. Rafael C Gonzalez, Richard E Woods," Digital Image Processing", Second Edition, Pearson Education Asia, 2002. (Chapter1,3, 4, 5, 6, 7, 8, 9,10,11)
2. Jorg Arndt, "DSP Algorithms for Programmers"(Chapter3)
3. Gonzalez. R & Woods B.E.," Digital Image Processing", Addison Wesley Longman Pearson Education,2000.

REFERENCE BOOKS

1. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning,Second Edition, 2001.
2. William J Prati, "Digital Image Processing", John Wiley &sons
3. TinkuAcharya, Ajoy K Ray, "Image Processing Principles and Applications Principles and Applications", Wiley- Inter science.

WEB REFERENCES:

1. https://www.slideshare.net/Johnrebel999/image-trnsformations?next_slideshow=1
2. https://nptel.ac.in/courses/117105079/12
3. https://nptel.ac.in/courses/117105079/13
4. https://nptel.ac.in/courses/117105079/14
5. https://nptel.ac.in/courses/117105079/15

LINUX PROGRAMMING

Course Code : 17 EM 40B1 **L-T-P 3-0-0**

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course outcome	Mapped PO	BTL
CO1	Describe and understand the fundamental LINUX operating system and utilities	1,2	2
CO2	apply shell scripts in order to perform basic shell Programming and analyze the Linux file system	5	3
CO3	Analyze the process concepts and create applications using and signal concepts IPC mechanisms	2,5	3

SYLLABUS:

Linux Utilities-File handling utilities, Security by file permissions, Process utilities ,Disk utilities Text processing utilities, and Backup utilities Sed- scripts, operation, addresses, commands, applications, Awk execution, field and records , scripts, operation, patterns, actions functions using system commands in awk.

Working with Bourne again Shell (bash) responsibilities, here documents , running shell script, Shell as a programming language, shell meta characters, Control structures, arithmetic in shell, examples Interrupt processing, functions, debugging shell scripts.

Files : file Concept , File System Structure, I nodes, File Attributes, File types Library functions ,standard and formatted I/O in C, stream errors Kernel support for files ,System calls, file descriptors, low level file access File structure related system calls (FILE APIS), file and record locking File and directory management-Directory file APIS, Symbolic links and hard links

Process concept, Kernel support for process, process attributes, process creation , waiting for a process, Process termination ,Zombie process, orphan process, Process APIs Introduction to signals, signal generation and handling ,Kernel support for signals, signal function, unreliable signals , reliable signals Kill ,raise, alarm, pause, abort, sleep functions

Introduction to IPC , pipes, FIFOs- Introduction to three types of IPC-message queues, semaphores and shared memory -Kernel support for messages, Unix system V APIs for messages- Client /Server example

Text Books:

Unix and Shell Programming , B. A. Forouzan and R.F Gilberg, Cengage learning

Unix Concept and Applications, 4th edn. Sumitabha dasTMH

Beginning Linux programming 4th edn. N. Matthew , R stones Wrox Wiley India edn.

Reference Books:

Linux system Programming , Robot Love, O;Reilly, SPD

Unix Network Programming , W.R. Stevens , PHI

Unix Internals , U Vahalia , Pearson Educaiton

UnixandshellProgramming,S.G.KochanandP.Word3rdedn.PearsoEdn.

E-COMMERCE

Course Code : 17 EM 40B2 **L-T-P 3-0-0**

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course outcome	Mapped PO	BTL
CO1	Analyze various E-Commerce Business Models and Infrastructure	7	2
CO2	Understand the Ethical, Social and Political issues in E-Commerce	8	1
CO3	Analyze Marketing communications and Internet resources for E-Commerce	5	2

SYLLABUS

Electronic Commerce: Revolution. E-Commerce Business models and concepts: The Internet and World Wide Web: E-commerce infrastructure. Building an E-commerce web site, online Security and payment systems, E-Commerce Marketing concepts, , Ethical, Social and Political issues in E-Commerce, Retailing on the Web, Online Service industries, B2B E-Commerce: Supply chain management and collaborative commerce. E-Commerce Marketing communications, Internet Resources for Commerce: Technologies for Web Servers, Internet Applications for commerce, Internet Charges, Internet Access and Architecture, Searching the Internet

Text Books:

1. Kenneth C.Laudon, Carol G.Traver , E-Commerce, (Pearson Education)

Reference Books:

1. Daniel Minoli,Emma Minoli,'Web Commerce Technology Handbook',(TMG)

2. Elias M.Awad'Electronic Commerce'(PHI)

RENEWABLE ENERGY RESOURCES

Course Code : 17 EE 40B3 **L-T-P: 3-0-0**

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Pre Requisite: NIL Credits : 3

Mapping of Course outcomes with student outcomes

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Understand and analyze the solar thermal applications and solar photovoltaic cells.	1,12	1
CO 2	Analyze the performance of wind and tidal, wave and Ocean thermal energy conversion systems	2,4	2
CO 3	Understand and analyze the operation of geothermal and bio energy conversion	1,12	1
CO 4	Understand and analyze the biogas digesters and bio power plants	1,12	1

SYLLABUS:

Extraterrestrial solar radiation, terrestrial solar radiation, solar thermal conversion, flat plate and concentrated solar thermal collectors, solar ponds, solar heating/cooling technique, solar distillation, photovoltaic energy conversion, solar cells – 4 models.

Planetary and local winds, vertical axis and horizontal axis wind mills, principles of wind power, maximum power, actual power, wind turbine operation, yaw control, pitch control and stall control mechanisms, derivation of power coefficient.

Ocean temperature differences, principles of OTEC plant operations, wave energy, devices for energy extraction, tides, simple single pool tidal system.

Origin and types, Bio fuels, classification, direct combustion for heat and electricity generator, anaerobic digestion for biogas, biogas digester, power generation.

Biomass energy conversion technologies, Biogas generation – classification of

Biogas plants. Micro hydro electric systems- different types of turbines.

Text books*:*

1. Godfrey Boyle “Renewable Energy”, Oxford Publications, Second edition.

2. G. D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, First edition.

Reference books*:*

1. Roger H.Charlier, Charles W. “Ocean Energy- Tide and Tidal Power”ISBN: Library of Congress Control Number: 2008929624_c Springer-Verlag Brerlin Heidelberg 2009.

2. John Twidell & Toney Weir: E&F.N. Spon, “Renewable Energy Sources”, Taylor & Francis New York, 2nd edition.

3. John F.Walker & N.Jenkins, "Wind Energy Technology", John Willey and Sons Chichester, U.K – 1997

ROBOTICS

Course Code : 17 ME 40B4 **L-T-P: 3-0-0**

Pre Requisite: NIL Credits : 3

Mapping of Course outcomes with student outcomes

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Analyze existing robotic systems with respect to their anatomy, type, performance specifications, end effectors etc.	4	2
CO 2	Suggest a robotic system design with respect to the suitable sensors, actuators for an intended application and simulate its performance	3	2
CO 3	Analyze robot manipulator performance with respect to digital control architecture comprising of PLC's /Microcontroller for an application	4	2
CO 4	Understand different programming languages	3	2

SYLLABUS

Introduction to Robotics, Major components of a Robot, Robotic like devices, Classification of Robots – Classification by coordinate system and by control method, Specifications of Robots, Fixed versus flexible automation, economic analysis.

ROBOT END EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, considerations in the selection and design of remote centered devices.

ROBOTIC SENSORY DEVICES: Objective, Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental).

PROXIMITY SENSORS: Contact type, non-contact type – reflected light scanning laser sensors.

TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photodetector sensors, Slip sensors – Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.

TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – Denavit Hartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.

Introduction to Trajectory Planning, the manipulator jacobian.

ROBOT APPLICATIONS: Industrial Applications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spray painting, grinding, Assembly and Inspection and Non-Industrial Applications.

ROBOT LANGUAGES: Introduction, AL, AML, VAL, RAIL

TEXT BOOK

1. Robotic engineering by Richard D. Klafter, Prentice Hall India
2. Industrial robotics by Mikell P.Groover, Mcgraw Hill Publications

REFERENCE BOOKS:

1. Robotics – K.S. Fu, Gonzalez & Lee, Mcgraw Hill Publications
2. Robotics For Engineers by YoramKkoren, Mcgraw Hill Publications
3. Introduction to Robot Technology, - P.Coiffet and M.Chairenze / Kogam Page Ltd. 1983 London.

MECHATRONICS

Course Code : 17 ME 40B5 **L-T-P: 3-0-0**

Pre Requisite: NIL Credits : 3

Mapping of Course outcomes with student outcomes

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Identify appropriate sensors, actuator, microcontrollers etc. for a given application	3	2
CO 2	Model system performance and estimate the expected system behaviour	4	2
CO 3	Suggest a mechatronic product design for the intended application and evaluate its performance	3	2
CO 4	Understand digital logic and PLC	3	2

SYLLABUS

K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INTRODUCTION TO MECHATRONICS: Introduction, Elements of Mechatronic system, Applications.

SENSORS AND TRASDUCERS: Introduction, Classification of Sensors, selection of sensors. Classification of transducers - strain gauges, displacement transducers, capacitive and inductive transducers, LVDT, oscillation transducer, piezoelectric, potentiometric, velocity transducers, temperature transducers, optical transducers.

SIGNAL CONDITIONING: Introduction, data acquisition –Quantizing theory, Analog to Digital conversion, Digital to Analog conversion.

DATA PRESENTATION SYSTEMS: Data presentation elements, Data acquisition systems, systems measurement, Testing and calibration.

ACTATION SYSTEMS: Pneumatic and hydraulic actuation systems, Stepper and Servo Motors

SYSTEM MODELS: Modeling of one and two degrees of freedom Mechanical, Electrical, fluid and thermal systems. Block diagram representations for these systems.

SYSTEM RESPONSE: Introduction, Transfer function, Time response and Frequency response analysis mechanical systems and electrical systems.

CLOSED LOOP CONTROLERS: Continuous and discrete processes, control modes, Two-step, proportional, Derivative, integral, PID controllers.

DIGITAL LOGIC: Logic gates, Boolean algebra, Karnaugh maps**.**

PLC: Introduction, basic structure, I/P ,O/P processing, programming, ladder diagrams, Timers, Internal relays and counters ,data handling, Analogue Input and Output, selection of a PLC**.**

DESIGN: Mechatronics system Design, possible design solutions.

CASE STUDY: pick and place Robot, CNC Machine.

TEXT BOOKS:

1. *W.Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" , 3rd Edition, Pearson education,2007.*
2. David G. Alciatore, Michael B. Histand ," Introduction to mechatronics and measurement systems", 2nd Edition, McGraw-Hill Professional, 2002.

REFERENCE BOOKS:

1. A.K.Sawhney, "A course in Electrical and Electronic Measurement and Instrumentation"- Dhanpat Rai & Sons - 1991.

2. Nitaigour Premchand Mahalik, "Mechatronics", Tata McGraw-Hill, 2003.

3. HMT Limited, "Mechatronics", McGraw-Hill Education (India) Pvt Ltd, 2000.

4. T.G. Beckwith & N.L.Buck, "Mechanical Measurements", 3rd Edition, Addison-Wesley Pub. Co., 1969.

OPERATIONS RESEARCH

Course Code : 17 ME 40B6 **L-T-P: 3-0-0**

Pre Requisite: NIL Credits : 3

Mapping of Course outcomes with student outcomes

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Model and solve for the optimum solutions using LPP	1	2
CO 2	Model and optimize transportation and assignment problems	4	2
CO 3	Model and optimize Game theory, DPP, Queuing theory & Simulation problems	2	2
CO 4	Understand concepts of PERT/CPM	3	2

SYLLABUS:

Introduction to Operation Research: Introduction, Modeling in Operations Research, Phases of OR study, Scope and application of OR. Linear Programming and its Applications: Linear Programming Problem – Graphical solution of LP Problem. Simplex method, Big M method, two phase method, multiple solution, infeasible solution, unbounded solution, degeneracy, Dual Simplex method. Transportation: Introduction – Methods of basic feasible solution, Optimality test, Degeneracy in transportation problem, unbalanced transportation Problem, Assignment Problems: Hungarian method for assignment problem, Traveling salesman problem. Theory of Games: Introduction, to solve the rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, solution of a two person zero sum 2Xn game, Graphical method for 2Xn and nX2 games. Inventory Control: Introduction – EOQ with uniform rate of demand, Economic lot size with finite rate of replenishment, Quantity discounts, Deterministic model with Shortages, ABC analysis of inventory. Dynamic Programming: Introduction, Bellman's principle of optimality, application to shortest route problem, linear programming, tabular method. Queuing Theory: Introduction, single channel, Poisson arrival, exponential service

time with finite population and infinite population, Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control. Project Management by PERT/CPM: Introduction, simple network techniques, construction rules of drawing, Fulkerson's rule, Critical path method (CPM)- floats, critical path, project duration, PERT: Introduction, different Time estimates, expected time, variance, expected project duration and probability of completion. Crashing: Introduction, crashing of network, problem

Text Books:

1. Operations Research - Hamdy Taha
2. Operations Research – Hiller & Liberman.

Reference Books:

1. Quantitative Techniques – A.P. Natarajan
2. Operations Research – S.D. Sarma

NANO MATERIALS AND TECHNOLOGY

Course Code : 17 PH40B7 **L-T-P: 3-0-0**

Pre Requisite: NIL Credits : 3

Mapping of Course outcomes with student outcomes

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Understand the essentials of nanomaterials and nanotechnology along with various methods used to fabricate nanomaterials. Also, recognize the several techniques used to characterize nanomaterials	3,12	1
CO 2	Understand the mechanical, optical & electrical properties of nanomaterials and also understand the concepts and applications of carbon based nanomaterials	3,12	1

SYLLABUS:

Introduction : Evolution of science and technology, Introduction to Nanotechnology, Nanotechnology-Definition, Difference between Nanoscience and Nanotechnology, Feynman predictions on Nanotechnology, Moore's law, Bottom up and top down approaches, challenges in Nanotechnology .

Nano materials : History of materials, Nanomaterials-Definition, Classification of Nanostructured materials, causes of interest in nanomaterials, some present and future

applications of nanomaterials, Bio-Medical Applications-Drugs, Drug Delivery, Photodynamic therapy, Molecular motors, Neuro-Electronic Interfaces, Protein Engineering, Nanoluminescent tags.

Synthesis and processing of nanoparticles, thin films : Nanoparticles: Processes for producing ultrafine powders-mechanical milling, wet chemical synthesis, gas condensation process, chemical vapour condensation, laser ablation.

Thin Films: Synthesis techniques- Physical Vapor Deposition: Evaporation, Molecular beam epitaxy, Sputtering. Comparision of evaporation and sputtering.

Special nanomaterials, characterization and tools : Carbon nanotubes, nano composites, carbon fullerenes-An overview over preparation, properties, applications. Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy– X ray Diffraction.

MEMS: – Introduction, types of MEMS:- Mechanical, Thermal, Magnetic MEMS; Fabrication of MEMS.

Text Books

1. Nano structures & Nano materials by Guozhong cao, Imperial college press.
2. Micro manufacturing and Nano Technology by N.P.Mahalik.

Reference Books

1. Nano Technology by Mark Ratner & Danier Ratner, Prentice Hall
2. Nano materials by A S Edelstein& R C Cammarata, Institute of physics publishing, Bristol and Philadelphia

SUBSEA ENGINEERING

Course code: 17 PE 40B8 **L-T-P: 3-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of the course outcomes with student's outcomes.

CO No.	Course outcome's	Mapped PO	BTL
CO 1	Understand the subsea engineering, field development, distributions system used in subsea.	1	1
CO 2	Apply the surveying to the subsea, understand the control system in subsea, understand the effect of corrosion and scale on the subsea equipment	1,2	2

CO 3	Understand the why normal conventional equipment is not utilized in subsea (well head, X trees, risers, pipelines)	1,2	1

Syllabus:

Overview of subsea engineering, subsea field development, distribution systems, subsea surveying positioning and foundation, installation of subsea equipment, subsea control, power supply, subsea hydraulics, subsea corrosion and scale, subsea connections and jumpers, subsea well heads and X-trees, subsea drilling risers, subsea production risers, subsea pipelines, subsea risk and reliability.

Reference Books:

1. Yong Bai, Qiang Bai, "Subsea engineering handbook", Gulf publishers, (2010)
2. Yong Bai, Qiang Bai, "Subsea pipeline and risers", Gulf publishers, (2005)
3. Boyun Guo, Shanhong Song, Jacob Chacko, Ali Ghalambor, "Offshore Pipeline", Gulf publishers, (2005)

OIL AND GAS MANAGEMENT

Course code: 17 PE 40B9 **L-T-P: 3-0-0**

Pre Requisite: NIL **Credits: 3**

Mapping of the course outcomes with student's outcomes.

CO No.	Course outcome's	Mapped PO	BTL
CO 1	Understand the global oil and gas market	1	1
CO 2	Understand the E&P activities, marketing and transportation of oil and gas	1	1
CO 3	Understand the refining activities, estimating the future of oil and gas industry	1	1

Syllabus:

Global Oil and Gas: Value Chain and Geopolitics of Oil

The Upstream: Exploration, Development, and Production

The Midstream: Markets and Transportation

The Downstream: Refining and Marketing

The Future Oil and Gas Industry

Reference Books:

1. Adedeji B. Badiru Samuel O. Osisanya, "Project Management for the Oil and Gas Industry", CRC Press, 2013.

2. Use Internet sources for present trends.

SELF DEVELOPMENT

Course Code : 17 GN 40C1 **L-T-P 3-0-0**

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course outcome	Mapped PO	BTL
CO1	Illustrate and realign values based on goal.	6,8,12	**2**
CO2	Demonstrate various types of Yoga and identify commonalities of different religions.	6,8,12	**2**
CO3	Illustrate practices of different Schools of Meditation and self-motivated approach to pursue a balanced life	6,8,12	**2**
CO4	Demonstrate techniques of stress management and Self-management focused interest in a Spiritual Practice	6,8,12	**2**

SYLLABUS:

Orientation, Discussion on Values : Understanding Values, Behavior and Attitudes, Application of Values and Universal Values, **Philosophy of Yoga :** God, Self and Ultimate goal of yoga, Brief Introduction to various types of yoga and Integration of values in Yoga, **Study of major Religions :** Identify commonality, condition of its origin or intention vs. current state, **Art of Meditation :** Observation, Introspection, Contemplation, Meditation and Concentration, Schools of Meditation, **Systematic Practice of Meditation:** Theories of life, Need for Meditation, Natural Path, Integration **Personal Responsibility:** Stress Management, Tips for Self-Management, Choices we make, Excellence.

Text Book :

1. Self development modules from Heartfulness Institute Initiative of Shri Ram Chandra Mission (www.heartulness.org)

Reference Books :

1. Complete works of Swami Vivekananda
2. Jonathan –Livingston - Seagull
3. The Monk Who Sold His Ferrari_Robin S. Sharma
4. You can win by shiv khera
5. Many lives Many Masters
6. The road less travelled – Scott Peck
7. As a man thinketh

8. Journey of the Soul
9. The Bhagavad-Gita
10. King James version of the Holy Bible
11. Holy-Quran

INDIAN CULTURE AND HISTORY

Course Code : 17 GN 40C2 **L-T-P 3-0-0**

Prerequisite: Nil **Credits:** 3

Mapping of Course out comes with student out comes:

CO No.	Course outcome	Mapped PO	BTL
CO1	**Understand** the basic features of Indian Culture and early civilizations of Indian History up to Religious Movements	**6**	**1**
CO2	**Gain basic knowledge** in the major socio political concepts of important kingdoms from Mauryas to Mughals.	**6**	**1**
CO3	**Gain Knowledge** in the aspects of Modern India and Indian National Movement up to	**6**	**1**
CO4	**Acquire Knowledge** in the area of Final Phase of Indian National Movement and partition of India	**6**	**1**

SYLLABUS:

Indian culture – characteristics, Salient aspects of Indian Music and Dance - brief introduction of Architecture and Painting.

Pre-Historic Period- Indus Valley Civilization- Vedic Age - Emergence of Mahajanapadas - Age of Religious Movements: Jainism, Buddhism - The Age of the Guptas.

Transformation from the Ancient Phase to Medieval Phase - The Delhi Sultanate - Beginning of Indo-Islamic Culture - Emergence of Provincial Kingdoms - The Mughals - Rise of Independent Autonomous States - The Marathas (1649-1748)

Advent of European Commerce - British Expansion in India - The British Administrative Structure in India- British Policy towards Economy of India - Social and Cultural Awakening in the 19th Century - Education under the British Rule.

The Growth of Nationalism - Foundation of the India National Congress- Growth of Extremism or Militant Nationalism and Partition of Bengal- Beginning of Communalism-

Revolutionary Terrorism and Home Rule Movement- Beginning of the Gandhian Era and the Non-Cooperation Movement - Resurgence of Revolutionary Terrorism (1924-1934)- Trade Union Movement - Civil Disobedience Movement - Second world war and the National Movement- Quit India Movement- Subhash Chandrabose and Indian National Army- The Final Phase: Independence and Partition

REFERENCES:

7. Facets of Indian Culture- Spectrum Publications
2. Ancient India: National Council of Educational Research and Training
3. Medieval India: Part I & Part II: National Council of Educational Research and Training.
4. Modern India: National Council of Educational Research and Training.
5. Ancient India: V.D. Mahajan: S. Chand & Company Ltd., New Delhi
6. An Advance History of India: R.C. Majumdar, H.C. Raychaudhuri & Kalikinkar Datt: Macmillan India Ltd.,
7. The Wonder that was India : A.L.Bhasham.
8. India's struggle for Independence 1857-1947: Bipan Chandra: Penguin Books
9. History of Freedom Movement in India: Vol. 1 to IV: Tara Chand: Publications Division
10. Essays on Contemporary India: Bipan Chandra: Har-Anand Publications.

EMOTIONAL INTELLIGENCE

Course Code : 17 GN 40C3 **LTP: 3-0-0**

Prerequisite : NIL **Credits : 3**

Syllabus:

Course Objective: The main objective of the course is to enable the students understand meaning and importance of emotional intelligence.

Emotional Intelligence: The Concept, dimensions of emotions; Theories of Multiple intelligences; importance of emotions; emotions and the brain; The Role of Emotions in Organizations; Self-Awareness and Self-Control; Empathy; Social Expertness; Personal Influence.

Emotional Intelligence and Personality: relationship between EQ and IQ; human mind; consequences of low and high EQ; EQ development; Emotional Skills; emotional factors: Emotional Competency, Emotional Maturity, and Emotional Sensitivity**.**

Levels of EI: Models of Emotional Intelligence; emotional intelligence competencies; emotional intelligence and leadership behavior; emotional intelligence and stress management; art of influencing people.

The Role of Emotional Intelligence in Professional Success: Emotional Intelligence and the Complexity of Work; Emotional Intelligence and High IQ Professions; Emotional Intelligence and Leadership; manage emotional upsets; Emotional 'Winner'**.**

EQ in the Indian Perspective; EQ and Managerial Effectiveness; the soft art of being a tough leader.

Recommended Textbook(s):

1.Dalip Singh - Emotional Intelligence at Work: A Professional Guide – Response Books – 2006.

Reference Books:

1.Daniel Goleman, Emotional Intelligence, Bantam Books, 2006.

2.Moshe Zeidner, Gerald Matthews, and Richard D. Roberts, What We Know About Emotional Intelligence – How It Affects Learning, Work, Relationships, and Our Mental Health, The MIT Press, 2009.

3.James Bradford Terrell and Marcia Hughes , A Coach's Guide to Emotional Intelligence: Strategies for Developing Successful Leaders , Wiley, 2008.

4.Dr. Jeanne Segal , The Language of Emotional Intelligence, McGraw-Hill, 2008

PROFESSIONAL ETHICS AND VALUES

Course Code : 17 GN 40C4 **L-T-P: 3-0-0**

Prerequisite : NIL **Credits : 3**

Syllabus:

Professional Ethics is the application of moral reasoning to established professions such as legal, medical, nursing, engineering, journalistic, and so on. Moral reasoning entails the search for values and principles that promote a good life and human flourishing. Professionals employ their expertise in ways that greatly affects the lives of others. It is critically important that professionals are thoughtful and reflective about the role of ethics in their work. Through successful completion of course readings andf assignments – and through active participation in class discussions – students will hopefully gain the tools to identify and analyze ethical issues.

Values in human society and types of values: Understanding of values; definition; culture and values; The wider applications of values; societal values; aesthetic values; organizational values; spiritual values;

Ethics and ethical values: Importance of values; value crisis at individual level, societal level, cultural level; social disorganization; value crisis management; Canons of ethics; types of ethics.

Professional ethics: Overview; ethics in engineering prolfession; code of professional ethics; organizational ethics; Violation of code of ethics: causes and consequences; Whistle blowing; Work place ethics, Women related issues; Industry and Industrialization: Problems of man-machine interaction; impact of assembly line and automation; industrial relations; ethics and industrial law.

Science, Technology and Engineering: Engineering as a profession; renewable and non-renewable resources; sustainable development; technology transfer; joint ventures of technology transfer and subsequent Indianization.

Environment and Eco-friendly technology: What is environment? Human development and environment; pollution and pollution control; Eco-friendly technologies, Green pactices.

Recommended Text Book(s):

1. Samita Manna and Suparna Chakraborti, 2010, **Values and Ethics in Business and Profession**, Published by Asoke K. Ghosh, PHI Learning Pvt. Ltd., M-97, Connaught Circus, New Delhi – 110001

Reference books:

1. William O' Donohue, Kyle Ferguson, 2003, **Handbook of Professional Ethics for Psychologists**, Sage Publications, Inc., California.
2. S. Dinesh Babu, 2007, **Professional Ethics and Human Values**, Laxmi Publications, Pvt. Ltd., 113, Golden House, Daryagunj, New Delhi-2.

3. Vaisali R. Khosla, Kavitha Bhagar, 2009, **Human Values and Professional Ethics,** first edition, Technical Publications, Pune.
4. R S Nagarazan, 2007, **A Text Book of Processional Ethics and Values**, New Age International.
5. A. Alavudeen, R. Kalil Rahman, M. Jayakumaran, 2008**, Professional Ethics and Human Values**, Laxmi Publications, Pvt. Ltd., 113, Golden House, Daryagunj, New Delhi

BEHAVIORAL SCIENCES

Course Code : 17 GN 40C5 **LTP: 3-0-0**
Prerequisite : NIL **Credits : 3**

Course Objective : The objective of the course is to increase the students' knowledge of behavioral aspects of individuals and interactions among the individuals and the groups.

Introduction to Behavioural Science; Foundations of Individual Behavior: Personality- Personality determinants; Personality traits: The Big Five Model, Major personality attributes influencing OB; Theories of personality; Values – Types of Values.

Learning- Theories of learning; Principles of learning; Attitudes – Source of attitudes; Types of Attitudes, Attitudes and consistency – Cognitive Dissonance theory.

Perception- Perceptual process; Factors influencing **Perception;** perceptual distortion; Linkage between perception and individual decision making; Motivation – Theories of Motivation – Hierarchy Needs Theory – Two-Factor Theory – Expectancy Theory; Applications of Motivation.

Foundations of Group Behavior: Groups – Nature of groups; Types of groups; Stages of Group Development; Group Cohesiveness; Teams vs Groups

Leadership – Nature; Leadership Styles; Theories of leadership: Trait Theories, Behavioral Theories and Contingency Theories.

Recommended Text Book(s):

1. Aswathappa, **Organizational Behaviour**, Himalaya Publishing House, 2010.

Reference books:

1. Robbins, Stephen, Timothy, A & Sanghi, S. **Organizational Behavior**, 13th Edn, Pearson Education. 2009.
2. Fred Luthans, **Organizational Behaviour**, Prentice Hall, 2007.
3. Udai Pareek, **Organizational Behavior**, Oxford Publishers, New Delhi, 2008.

MANAGEMENT ELECTIVES

PARADIGMS IN MANAGEMENT THOUGHT

COURSE CODE: 17MB4051 **L-T-P-S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Management Introduction - Early management thought - Management Concept – Nature - Management as art, science, profession - Scope and functions of Management - Levels of Management - Importance of management. **Classical Approach to Management: (a) Scientific Management-** The advent of Scientific Management – Frederick W Taylor's contributions, - Contribution by Henry L Gantt - Contribution by Frank, Lillian Gilberth. **General Administrative Approach**: Henry Fayol's contributions towards general management – Max Weber's Bureaucracy Approach. **Quantitative Approach:** Important contributions – TQM – implications in today's management – Six sigma. **Behavioral Approach**: Organizational Behaviour – Contributions of Elton Mayo's – .Hawthorne studies

– contributions of Mary Parker Follett – Chester Bernard. **Contemporary Approach:** Systems Theory – Contingency Theory – Chao's Theory -Peter F Drucker Contributions – C K Prahlad's Contribution – Porter's theory – Worker Management – Employee Engagement – People Capability Maturity Model.

Text Book(s):

1. Management by Stephen P Robbins, Mary Coulter, Neeharika Vohra – Pearson – 10th edition

Reference Books:

1. Management by Stoner, Freeman, Gilbert – PHI – 7th edition.
2. Management A Global & Entrepreneurial Perspective – Weihrich, Cannice, Koontz – Mc Graw Hill – 13th Edition.
3. The evolution of management thought by Daniel A Wren, Arther G Bedeian : john wiley& sons

INDIAN ECONOMY

COURSE CODE: 17MB4052 **L-T-P-S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

SYLLABUS: Economy: Meaning, types, problems and functions – Features of Indian Economy: Circular flow of economic activity: two sector, three sector and four sector models. Sectoral distribution of the economy. Nature and features of Indian Economy; Sectoral contribution of National Income-Share of Public and Private Sectors in GDP.

Agricultural Sector of India: importance and general problems; Land Reforms, Agricultural marketing problems and remedies. Industrial Sector of India: Types, Importance and general problems: Small Scale Sector: Importance and general problems.

Tertiary Sector in India- Importance – Infrastructure Development – Transport – Roadways, Railways – Banking and Insurance –Communication – Science and Technology – Software. Personal Income distribution and causes of inequality - Unemployment causes and remedial measures; Poverty in India- Poverty Line – antipoverty programs. Human development: concept and measurement - Human Development Index.

Economic Planning in India: Role of Planning Commission - Over all Objectives and achievements of various Five Year Plans. 12th Five Year Plan; Economic Liberalisation: LPG strategy-General Agreement on Tariffs and Trade (GATT) - Objectives of GATT and Evolution of WTO – WTO and the Indian Economy, NABARD and World Bank.

Recommended Text Book(s):

1. G.Dutt and K.P.M.Sundaram: Indian Economy (2011), S.Chand&Co., New Delhi.
2. S.K.Mishra and V.K.Puri: Indian Economy, 30th ed., Himalaya Publishing House, New Delhi.
3. M.L.Jingan: Macro Economics, 6th ed., Konark Publishing House.

Reference Books:

1. P.K.Dhar, Indian Economy-Its growing dimension, Kalyani Publishers.
2. Alok Ghosh, Indian Economy, Its Nature and Problem, World Press.
3. A.N.Agarawal, Indian Economy- Problems of Development and Planning, New Age

MANAGING PERSONAL FINANCES

COURSE CODE: 17MB4053 **L-T-P-S: 3-0-0-0**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Pre Requisite: NIL **Credits: 3**

SYLLABUS: Financial planning process: Introduction-Importance of Financial Planning-Process of financial planning -The planning environment-Determinants of personal income-Financial statements and plans-Concept of Time value of money - Preparing a personal balance sheet - Preparing the income and expense statement-Using personal financial statements - Ratio Analysis.

Managing Taxes: Introduction-Importance of tax planning-Basic concepts of income tax - Personal taxation -Income tax benefits on certain long term investments -Tax planning-Ethical consideration in tax planning.

Making decisions regarding houses and automobiles:- Meeting housing needs-The rental option - The home buying process - Financing the housing transaction - Housing finance institutions in India - Housing schemes in India- Automobile purchase planning.

Planning for Investments:- Types of investment vehicles-Factors considered in the choice of investments- Developing the investment strategy-Investing in Equities- Investment Process-Investing in Fixed Income Securities- Bond Market-Bond Investing Strategies-Types of Bonds-Bond Returns- Risks from Investing in Bonds

Insurance & Mutual Funds:-Insurance planning - Buying a life insurance - Life insurance products in India- Health Insurance-Need-Types and Sources of health care plans-Providers of Health care-Long term care insurance-Disability income insurance-Health Insurance in India; Mutual funds – Types of mutual fund products – Objectives of investing in Mutual funds.

Recommended Text Book(s):

1. Jack R Kapoor, “Personal Finance” Mc Graw Hill Publications, New Delhi, 2008.
2. KC Mishra and Steward Doss, “Basics of Personal Financial Planning” Cengage Learning, First Edition 2009.

Reference books:

1. Joehnk, Billingsley and Gitman “Planning Your Personal Finances” Cengage Learning India Private Limited, Delhi, 2012.
2. Mark Hirschey and John Nofsinger “Investments Analysis” and Behavior” Mc Graw Hill Publications, New Delhi, 2008.

BASICS OF MARKETING FOR ENGINEERS

COURSE CODE: 17MB4054 **L-T-P-S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Introduction and Nature of Marketing: Evolution of Marketing Concept - Core concepts of marketing - Scope and Importance of Marketing. -Difference between Selling and Marketing - Marketing Myopia - Consumer Marketing Vs. Industrial Marketing.

Understanding Consumer Behaviour: nature, scope and importance of consumer behavior – Factors influencing Consumer Behavior - Buying decision making process - Market Segmentation, Targeting and Positioning (STP).

Marketing mix - Product definition, levels of product, product classification, difference between goods and services, Product Life Cycle, New Product Development – Technology and Product Management - Concept of Pricing – Factors influencing the pricing policy – Pricing strategies - Pricing Considerations in High-Tech Markets.

Promotion mix - Marketing Communication Tools for High-Tech Markets - Channels of distribution - Supply Chain Management in High-Tech Markets - Technology Marketing, Green Marketing, Introduction to market study.

Text Books:

1. Philip Kotler and Gary Armstrong- Principles of Marketing- 17/e, Pearson Education.

2. Jakki J Mohr, Sanjit Sengupta and Stanley Slater, Marketing of High-Technology Products and Innovations, 3/e Pearson India

Reference Books:

1. V.S. Ramaswamy and S.Namakumari – Marketing Management, 4/e, Mc Millan Publications, New Delhi.
2. RajanSaxena, Marketing Management- 3/e, TMH, New Delhi.

ORGANIZATION MANAGEMENT

COURSE CODE: 17MB4055 **L-T-P-S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

SYLLABUS: Development of Management thought – Introduction, Various theories; Functional approach, scientific management approach, human relations approach, latest management thoughts, organization theory-classical organization, neo-classical organization theory, modern organization theory.

Organization Structure--Principles of organization, organizational theories, departmentalism, authority, power, organizing, organizational effectiveness, structuring the organization, organizational change, organization charts; types of organizations—line , functional and line and staff relations, Organizational manuals.

Motivation, Morale and behavioral science—Motivation: Characteristics, importance, Kinds of motivation. Thoughts of motivational philosophy: Gouglass Mc Gregore—X and Y theory; Herzberg's theory. Human needs, Incentive as motivators, Managing dissatisfaction and frustration. Morale, Absenteeism, Behavioral science, Group dynamics, Group behavior. Leadership—Meaning, importance, styles, theories, leaders Vs managers.

Management concept—Management, Administration, Organization, Difference and Relationship between Management, Administration and Organization, Importance of Management, Characteristics of management, Managerial Skills, Managerial Objectives, Harmonization of Objectives, Hierarchy of Objectives.

Industrial Relations, Trade Union and Collective Bargaining—Industrial relations, Industrial Psychology, Industrial disputes, Conflict management, Views about conflict, Labor Policy. Workers grievances, Suggestion system. Trade Unions. Collective Bargaining, Negotiations, Industrial Safety—working conditions, Accidents, Preventive measures, Safety training.

TEXT BOOKS

1. Stephen P. Robins, Organizational behavior, PHI / Pearson education, 11^{t} edition , 2008.
2. Koontz &Wehrich., Essentials of Management, 12th edition, Tata Mc Grawhill, 2007.

REFERENCES

1. Banga&Sarma , Industrial Engineering Management including Productionmanagement, 11th edition, 2010.
2. O.P. Khanna , Industrial engineering management, Khanna publications, 2006.

RESOURCE, SAFETY AND QUALITY MANAGEMENT

COURSE CODE: 17MB4056 **L-T-P-S: 3-0-0-0**
Pre Requisite: NIL **Credits: 3**

Resource Management (Man Power, Materials & Machinery): Introduction; Resource smoothing; Resource Leveling, Establishing workers productivity; Objectives of material management;Functions of material management department; ABC classification of materials; Inventory of materials; Material procurement; Storage management;Classification of construction equipment; Earth moving equipment; Excavation equipment; Hauling equipment; Earth compaction equipment; Hoisting equipment; Concrete plant and equipment; Time and motion study; Selection of equipment – Task consideration, cost consideration; Factors

affecting the selection; Factors affecting cost owning and operating the equipment; Equipment maintenance.

Safety and Quality Management: Accident prevention program; Immediate attention in case of accident; Approaches to improve safety in construction; Safety benefits to employees, employees and customers; Prevention of fire in construction industries; Fault tree analysis; Safety information system; Safety budgeting;Importance of quality; Elements of quality; Organization for quality control; Quality assurance techniques; Documentation; Quality control circles; Total quality management; ISO 9000 – 2008.

TEXT BOOKS:

1. Construction Engineering and Management by S.Seetharaman; Umesh Publications, NaiSarakl, Delhi.
2. Fundamentals of PERT/CPM and Project Management by S.K.Bhattacharjee; Khanna Publishers, NaiSarak; Delhi.

REFERENCE BOOKS:

1. Construction Management and Planning by B.Sengupta and H.Guha; Tata Mc.Graw-Hill Publishing Co. Ltd., New Delhi.
2. Construction Planning, Equipment and Methods by Peurifoy R.L; MC Graw-Hill International Book Company.

ECONOMICS FOR ENGINEERS

COURSE CODE: 17MB4057 **L-T-P-S: 3-0-0-0**

Pre Requisite: NIL **Credits: 3**

Introduction to Engineering Economics: Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Elementary economic Analysis

Unit II: Value Engineering: Make or buy decision, Value engineering – Function, aims, value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

Cash Flow: Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the method

Replacement and Maintenance Analysis: Introduction-Types of maintenance –types of replacement Problem-Determination of economic life of an asset-Replacement of existing asset with a new asset. Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction.

Text Books:

1. Dr. K K Patra, DhirajBhattacharjee, Engineering Economics and Costing, S. Chand & Company Ltd, New Delhi, 2013.
2. PanneerSelvam, R., ***Engineering Economics***, Prentice Hall of India Ltd, New Delhi, 2001.

Reference Books:

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