HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

Curriculum & Syllabus

2019-2020

CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

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VISION AND MISSION OF THE DEPARTMENT

VISION

To nurture Electronics and Communication Professionals with exemplary technical skills adorned with ethical values.

MISSION

M1. To expand frontiers of knowledge through the provision of inspiring learning environment

M2. To develop the intellectual skills towards employability by fostering innovation, and creativity in learning.

M3. To provide a quality system for wholesome learning to achieve progress and prosperity in life along with moral values

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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 anddesign 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.

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Graduates will be able to provide solutions for real time embedded systems using Internet of Things to meet the global needs.

PSO 2. Graduates will have the perseverance to design and develop products using cutting edge technologies in Signal processing and Communication systems.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. To prepare the graduates to solve, analyze and develop real time engineering products by providing strong foundation in the fundamentals of Electronics and Communication Engineering.

PEO 2. To prepare the graduates to succeed in multidisciplinary dimensions by providing adequate trainings and exposure to emerging technologies.

PEO 3. To prepare the graduates to become a successful leader and innovator following ethics with the sense of social responsibility for providing engineering solutions.

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CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING (UG)

REGULATION-2019

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER – I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1103	Calculus and Differential Equations	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19EC1153	Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19HE1071	Value Added Course I: Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
			Total	**13**	**2**	**10**	**20**	**350**	**350**	**700**
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

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SEMESTER - II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2103	Linear Algebra, Numerical Methods and Transform Calculus	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C & C ++ programming	ES	2	0	2	3	50	50	100
6	19ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
8	19HE2071	Value Added Course II: Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
			Total	**12**	**2**	**16**	**22**	**400**	**400**	**800**

REGULATION-2016

For the students admitted during the academic year 2018-2019 and onwards

SEMESTER III

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3106	Numerical Methods for Electronics Engineers	3	1	0	4	25	75	100
2	16EC3201	Digital Electronics	3	0	0	3	25	75	100
3	16EC3202	Signals and Systems	3	1	0	4	25	75	100
4	16EC3203	Electronic Circuits	3	0	0	3	25	75	100
5	16EC3204	Semiconductor Fabrication Technology	3	0	0	3	25	75	100
6	16CS3231	Data Structures and Algorithms	3	0	0	3	25	75	100
PRACTICAL									
7	16EC3001	Electronic Circuits Lab	0	0	4	2	50	50	100
8	16CS3031	Data Structures and Algorithms Lab	0	0	4	2	50	50	100
		Total Credits	**18**	**2**	**8**	**24**	**250**	**550**	**800**

SEMESTER IV

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA4109	Probability and Random Processes	3	1	0	4	25	75	100
2	16EC4201	Electro Magnetic Fields	3	0	0	3	25	75	100
3	16EC4202	Control Systems	3	0	0	3	25	75	100
4	16EC4203	Measurement and Instrumentation	3	0	0	3	25	75	100
5	16EC4204	Linear Integrated Circuits	3	0	0	3	25	75	100
6	16CS4232	Object Oriented Programming and Structures	3	0	0	3	50	50	100
PRACTICAL									
7	16EC4001	Digital Electronics Lab	0	0	4	2	50	50	100
8	16EC4002	Linear Integrated Circuits Lab	0	0	4	2	50	50	100
		Total Credits	**18**	**1**	**8**	**23**	**275**	**525**	**800**

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER V

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EC5201	Analog Communication	3	0	0	3	25	75	100
2	16EC5202	Digital Signal Processing	3	1	0	4	25	75	100
3	16EC5203	Data Communication and Networks	3	0	2	4	50	50	100
4	16EC5204	Microprocessors and Microcontrollers: Concepts and Applications	3	0	0	3	25	75	100
5	16EC5205	Transmission Lines and Waveguides	3	1	0	4	25	75	100
6	16EC53XX	**Professional Elective I**	3	0	0	3	25	75	100
PRACTICAL									
7	16EC5001	Digital Signal Processing Laboratory	0	0	4	2	50	50	100
8	16EC5002	Microprocessors and Microcontrollers Laboratory	0	0	4	2	50	50	100
		Total Credits	**18**	**2**	**10**	**25**	**275**	**525**	**800**

SEMESTER VI

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EC6201	VLSI Design	3	0	0	3	25	75	100
2	16EC6202	Digital Communication	3	0	0	3	25	75	100
3	16EC6203	Digital Image Processing	3	0	0	3	25	75	100
4	16EC6204	Antenna and Wave Propagation	3	0	0	3	25	75	100
5	16EC63XX	**Professional Elective II**	3	0	0	3	25	75	100
6	16XX64XX	**Open Elective I**	3	0	0	3	25	75	100
PRACTICAL									
7	16EC6001	Analog and Digital Communication Laboratory	0	0	4	2	50	50	100
8	16EC6002	VLSI Design Laboratory	0	0	4	2	50	50	100
9	16EC6801	Mini Project	0	0	4	2	100	0	100
		Total Credits	**18**	**0**	**12**	**24**	**350**	**550**	**900**

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
ELECTIVE I									
1	16EC5301	Analysis and Design of Digital Integrated Circuits	3	0	0	3	25	75	100
2	16EC5302	Computer Architecture and Organization	3	0	0	3	25	75	100
3	16EC5303	Medical Electronics	3	0	0	3	25	75	100
4	16EC5304	Principles of Management	3	0	0	3	25	75	100
5	16EC5305	Professional Ethics	3	0	0	3	25	75	100
6	16EC5306	TV and Video Engineering	3	0	0	3	25	75	100
ELECTIVE II									
1	16EC6301	Advanced Microprocessors	3	0	0	3	25	75	100
2	16EC6302	Cloud Computing	3	0	0	3	25	75	100
3	16EC6303	Network Security	3	0	0	3	25	75	100
4	16EC6304	Operating Systems	3	0	0	3	25	75	100

5	16EC6305	PCB Design	3	0	0	3	25	75	100
6	16EC6306	Wireless Sensors and Networks	3	0	0	3	25	75	100

OPEN ELECTIVE									
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	16EC6401	Consumer Electronics	3	0	0	3	25	75	100

For the students admitted during the academic year 2016-2017 and onwards

SEMESTER VII

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EC7201	Embedded and Real Time Systems	3	0	0	3	25	75	100
2	16EC7202	Wireless Communication	3	0	0	3	25	75	100
3	16EC7203	Microwave Engineering	3	0	0	3	25	75	100
4	16EC73XX	**Professional Elective III**	3	0	0	3	25	75	100
5	16EC73XX	**Professional Elective IV**	3	0	0	3	25	75	100
6	16XX74XX	**Open Elective II**	3	0	0	3	25	75	100
PRACTICAL									
7	16EC7001	Embedded Systems Lab	0	0	4	2	50	50	100
8	16EC7002	Optical Communication and Microwave Lab	0	0	4	2	50	50	100
9	16EC7701	Technical Seminar/Implant Training/Certification Course/Internship	0	0	2	1	50	50	100
		Total Credits	**18**	**0**	**10**	**23**	**300**	**600**	**900**

SEMESTER VIII

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EC83XX	**Professional Elective V**	3	0	0	3	25	75	100
2	16EC83XX	**Professional Elective VI**	3	0	0	3	25	75	100
PRACTICAL									
3	16EC8901	Project Work	0	0	20	10	100	100	200
		Total Credits	**6**	**0**	**20**	**16**	**150**	**250**	**400**

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
ELECTIVE III									
1	16EC7301	Embedded Controllers	3	0	0	3	25	75	100
2	16EC7302	Fiber Optic Communication	3	0	0	3	25	75	100
3	16EC7303	High Speed Networks	3	0	0	3	25	75	100
4	16EC7304	Internet and Java	3	0	0	3	25	75	100
5	16EC7305	Mobile Communication	3	0	0	3	25	75	100
6	16EC7306	Satellite Communication	3	0	0	3	25	75	100
ELECTIVE IV									
1	16EC7307	Artificial Intelligence	3	0	0	3	25	75	100
2	16EC7308	ASIC Design	3	0	0	3	25	75	100
3	16EC7309	Low Power VLSI	3	0	0	3	25	75	100
4	16EC7310	Network On Chip	3	0	0	3	25	75	100
5	16EC7311	Optimization Techniques	3	0	0	3	25	75	100
6	16EC7312	Robotics	3	0	0	3	25	75	100
ELECTIVE V									
1	16EC8301	ARM System Architecture and Applications	3	0	0	3	25	75	100
2	16EC8302	Automotive Electronics	3	0	0	3	25	75	100
3	16EC8303	E-Commerce Technology	3	0	0	3	25	75	100
4	16EC8304	Entrepreneurship Development	3	0	0	3	25	75	100
5	16EC8305	Industrial Automation	3	0	0	3	25	75	100
6	16EC8306	Real time Operating System	3	0	0	3	25	75	100
ELECTIVE VI									
1	16EC8307	Disaster Management	3	0	0	3	25	75	100
2	16EC8308	Foundation Skills in Integrated Product Development	3	0	0	3	25	75	100
3	16EC8309	Intellectual Property Rights and Innovations	3	0	0	3	25	75	100
4	16EC8310	Operations Research	3	0	0	3	25	75	100

5	16EC8311	Total Quality Management	3	0	0	3	25	75	100
6	16EC8312	VLSI and Signal Processing	3	0	0	3	25	75	100

OPEN ELECTIVE									
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	16EC7402	Internet of Things	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

R2016

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Credits	26	25	24	23	25	25	23	16	**187**

R2019

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Credits	20	22	20	21	22	22	20	18	**165**

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COIMBATORE - 641 032

SYLLABUS

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

- ✓ Train to maintain coherence in formal communication.
- ✓ Provide Practice to create and interpret descriptive communication.
- ✓ Introduce the professional protocol.
- ✓ Acquiredifferent types of communication and professional etiquette.
- ✓ Educate to improve interpersonal and intrapersonal skills.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** –Reading articles from newspaper, Reading comprehension **Writing** Chart analysis, process description, Writing instructions **Grammar and Vocabulary-** Tenses, Regular and irregular verb, technical vocabulary.	9
II	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) **Reading-** Reading technical articles **Writing-** Letter phrases, writing personal letters, **Grammar and Vocabulary-** articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking-** - listening to announcements **Reading-** Reading about technical inventions, research and development **Writing-** Letter inviting a candidate for interview, Job application and resume preparation **Grammar and Vocabulary-** Homophones and Homonyms.	9
IV	**Listening and Speaking-** - Practice telephone skills and telephone etiquette (listening and responding, asking questions).**Reading-** Reading short texts and memos **Writing-** invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary-** Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking-** listening to technical group discussions and participating in GDs **Reading-** reading biographical writing **- Writing-** Proposal writing, Writing definitions, **Grammar and Vocabulary-** Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1- To gain knowledge about basic grammar and elements of professional communication.
CO2- To understand formal and technical communication.
CO3- Toapply the basic elements of grammar and communication in professional situation.
CO4- To analyse and interpret different styles of correspondence.
CO5- Tocompose official letters and technical proposals and make presentations.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2-Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
R2- Raymond Murphy, "English Grammar in Use"-4thedition Cambridge University Press, 2004.
R3- KamaleshSadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA1103	CALCULUS AND DIFFERENTIAL EQUATIONS (COMMON TO EEE, ECE, EIE AND BM)	3	1	0	4

Course Objective

1. Understand the concept of differentiation.
2. Compute the functions of several variables which are needed in many branches of engineering.
3. Understand the concept of double integrals.
4. Understand the concept of triple integrals.
5. Solve ordinary differential equations of certain types using Wronskian technique.

Unit	Description	Instructional Hours
I	**DIFFERENTIAL CALCULUS** Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
II	**MULTIVARIATE CALCULUS (DIFFERENTIATION)** Total derivatives - Jacobians – Maxima, M inima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
III	**DOUBLE INTEGRATION** Double integral sin Cartesian coordinates– Area enclosed by the plane curves (excluding surface area)– Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12
IV	**TRIPLE INTEGRATION** Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12
V	**ORDINARYDIFFERENTIALEQUATIONS** Ordinary differential equations of second order - Second order linear differentia lequations with constant coefficients – Cauchy – Euler's Equation - Cauchy – Legendre's Equation - Method of variation f parameters.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute the area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids.
CO5: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1- Thomas & Finney "Calculus and Analytic Geometry", Sixth Edition,Narosa Publishing House, New Delhi.

R2 - Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition,Pearson India 2016.

R3 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19PH1151	APPLIED PHYSICS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young's modulus by uniform bending method	3
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum	3
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and it's applications - Diffraction of light –Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO_2 laser- Laser Applications – Holography – Construction and reconstruction of images.	6 3
	Determination of Wavelength and particl size using Laser	
V	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	**45**

Course Outcome

After completion of the course the learner will be able to

CO1: Illustrate the fundamental properties of matter
CO2: Discuss the Oscillatory motions of particles
CO3: Analyze the wavelength of different colors
CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA**	6 +3=9
II	**POLYMER & COMPOSITES** Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, Polymerization – types Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4. Estimation of Ferrous iron by Potentiometry.**	6+9 =15
IV	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. **Determination of iron content of the water sample using spectro photometer.(1,10 phenanthroline / thiocyanate method).**	6+3
	Total Instructional Hours	**45**

Course Outcome

CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life

CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.

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CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of
corrosion, its consequences to minimize corrosion to improve industrial design.
CO4: Develop knowledge about the renewable energy resources and batteries along with the need of
new materials to improve energy storage capabilities.
CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd,Chennai
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub. Co., New Delhi (2018).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand& Co. Ltd., New Delhi (2017).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objectives

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs
3. To develop Python programs with conditionals and loops and to define Python functions and call them
4. To use Python data structures – lists, tuples, dictionaries
5. To do input/output with files in Python

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). **Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.**	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.**	7+2
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.**	5+4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	3+6
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	5+4
	Total Instructional Hours	**29 + 16**

Course Outcome

CO1:Develop algorithmic solutions to simple computational problems
CO2:Read, write, execute by hand simple Python programs
CO3:Structure simple Python programs for solving problems and Decompose a Python program into functions
CO4:Represent compound using Python lists, tuples, dictionaries
CO5:Read and write data from/to files in Python Programs

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TEXT BOOKS

T1-Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised andupdated for Python 3.6.2, Shroff Publishers, First edition (2017).
T2-S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

REFERENCE BOOKS:

R1-Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.

R2-Timothy A. Budd, —Exploring Pythonl, Mc-Graw Hill Education (India) Private Ltd., 2015

R3-Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EC1153	ELECTRON DEVICES AND ELECTRICAL CIRCUITS	2	0	2	3

Course Objective

1. To be familiar with the theory, construction, and operation of PN junction and Zener diodes.
2. To impart knowledge on the construction, operation and models of BJT & FET.
3. To give an insight of the basic operation of special semiconductor devices
4. To introduce the concept of electric circuits and its analysis.
5. To introduce the phenomenon of circuit transients.

Unit	Description	Instructional Hours
I	**SEMICONDUCTOR DIODES** Theory of PN junction diode- Forward and Reverse bias characteristics- Breakdown in PN diodes- Diode current equations-Diode Applications-Zener diode and its characteristics. **Experimental study- Characteristics of PN Junction Diode and Zener Diode.**	6+3
II	**TRANSISTORS** Basic principle of operation of NPN and PNP configuration- Types of configurations - Input and Output characteristics of CE, CB and CC Configurations of BJT-JFET - Construction and working principle – Drain and Transfer characteristics -Comparison of JFET and BJT- MOSFET: E-MOSFET,D MOSFET - Comparison of JFET and MOSFET. **Experimental study –Input and Output Characteristics of BJT.**	6+3
III	**SPECIAL SEMICONDUCTOR DEVICES** UJT -Tunnel Diode-Thyristors-SCR,DIAC,TRIAC, LED, LCD, Photo diode, Photo Transistor, Opto Coupler, Solar cell, CCD. **Experimental study-Characteristics of photo diode.**	6+3
IV	**CIRCUIT ANALYSIS TECHNIQUES** Ohm's Law,Kirchoff's current and voltage laws – series and parallel connections-Mesh analysis -Nodal Analysis - Network Theorems :Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Superposition theorem. **Experimental study Verification of superposition theorem.**	6+3
V	**CIRCUIT TRANSIENTS AND TWO PORT NETWORKS** Basic RL, RC and RLC circuits and their responses to DC and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – Two port networks: Z and Y parameters. **Experimental study -Determination of Resonance Frequency of Series RLC Circuits**	6+3
	Total Instructional Hours	**30+15**

Course Outcome

CO1: Ability to explain the theory, construction, and operation of PN junction and Zenerdiodes.
CO2: Ability to explain the theory, construction, and operation of BJT & FET.
CO3: Understand the working of various power devices and display devices.
CO4: To apply network theorems for AC and DC Circuits
CO5: Understand the concept of transient response of circuits.

TEXT BOOKS:

T1- W David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5Th Edition,(2008).

T2- S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).

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REFERENCE BOOKS:

R1 - M.Robert T. Paynter, "Introducing Electronics Devices and Circuits", PearsonEducation, 7thEducation. (2006).

R2 - William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition. 2002.

R3 - J. Millman&Halkins, SatyebrantaJit, "Electronic Devices &Circuits",Tata McGraw Hill, 2nd Edition, 2008.

R4 - Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Prentice Hall, 10th edition, July 2008.

R5 - T.K.Nagsarkar, M.S.Sukhija," Basic Electrical Engineering",Oxfordpublications,second edition,2014.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ To enhance student language competency
- ✓ To train the students in LSRW skills
- ✓ To develop student communication skills
- ✓ To empower the trainee in business writing skills.
- ✓ To train the students to react to different professional situations

Unit	Description	Instructional Hours
I	**Listening** Listening to technical group discussions and participating in GDs. listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
II	**Reading** Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
III	**Writing** E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
IV	**Speaking** To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
V	**Speaking** Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE2101	BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

1. Introduce business communication.
2. Train to respond different professional situations.
3. Make the learners familiar with the managerial skills
4. Empower the trainee in business writing skills.
5. Educate to interpret and expertise different business content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	9
II	**Listening and Speaking-** listening to TED talks **Reading-**Making and interpretation of posters**Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" **Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	9
IV	**Listening and Speaking-** Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & ir	9
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company **- Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	9
	Total Instructional Hours	**45**

Course Outcome

CO1- To know different modes of business communication
CO2- To understand managerial techniques.CO3- To apply the rules of grammar and vocabulary in effective business communication.
CO4-To analyse and interpret business documents.
CO5-To draft business reports

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA2103	LINEAR ALGEBRA, NUMERICAL METHODS AND TRANSFORM CALCULUS (ECE)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Analyze various methods to find the intermediate values for the given data.
3. Explain the concepts of numerical differentiation and integration of the unknown functions.
4. Explain single and multi step methods to solve Ordinary differential equations
5. Discuss the concept of Laplace and Inverse laplace transform.

Unit	Description	Instructional Hours
I	**MATRICES** Eigen valuesand Eigen vectorsofarealmatrix– PropertiesofEigenvalues andEigenvectors (without proof)Cayley - Hamilton Theorem (excluding proof) - Orthogonal matrices–Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**INTERPOLATION** Interpolation - Newton's forward and backward difference formulae – Newton's divided difference formula and Lagrangian interpolation for unequal intervals.	12
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Numerical Differentiation: Newton's forward and backward interpolation formulae for equal intervals –Newton's divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson's 1/3 rule - Double integration using Trapezoidal and Simpson's rules	12
IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods for solving first order equations: Taylor's series method – Euler and Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne's predictor and corrector method.	12
V	**TRANSFORM CALCULUS** Laplace transform–Basic properties –Transforms of derivatives and integrals of functions Transforms of unit step function and impulse function– Transform of periodic functions. Inverse Laplace transform-Convolution theorem (with out proof) –Solution of linear ODE of second order with constant coefficients using Laplace transforms..	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies.
CO2: Apply various methods to find the intermediate values for the given data.
CO3: Identify various methods to perform numerical differentiation and l integration
CO4: Classify and solve ordinary differential equations by using single and multi step methods.
CO5: Infer the knowledge of Laplace and Inverse laplace transform

TEXT BOOKS:

T1- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018

T2- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

R1-BaliN.P &ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub. Pvt. Ltd. 2011.

R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

R3- Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program
2. Extend the knowledge about the magnetic materials
3. Explore the behavior of super conducting materials
4. Gain knowledge about Crystal systems
5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). Determination of band gap of a semiconductor Determination of acceptance angle and numerical aperature in an optical fiber	6 3 3
II	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. B – H curve by Magnetic hysteresis experiment	6 3
III	**PERCONDUCTING MATERIALS** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
V	**ULTRASONICS** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system. Determination of velocity of sound and compressibility of liquid – Ultrasonic wave Determination of Coefficient of viscosity of a liquid –Poiseuille's method	6 3 3
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor
CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday
CO3: Discuss the behavior of super conducting materials
CO4: Illustrate the types and importance of crystal systems
CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016
R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CY2151	ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The importance of environmental education, ecosystem and biodiversity.
2. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. The natural resources, exploitation and its conservation
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6+9=15
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.**	6
IV	SOCIAL ISSUES AND THE ENVIRONMENT From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3=9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. **Estimation of heavy metal ion (copper) in effluents by EDTA.**	6+3=9
	Total Instructional Hours	**45**

Course Outcome

CO1: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2: Understand the causes of environmental pollution and hazards due to manmade activities.
CO3: Develop an understanding of different natural resources including renewable

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resources

CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.

CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1- S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020

T2 – Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

R1 – ErachBharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3 - Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19CS2152	ESSENTIALS OF C & C++ PROGRAMMING	2	0	2	3

Course Objective

1. To Learn and develop basics of C programming
2. To understand Object Oriented Programming concepts and basic characteristics of C++.
3. Be familiar with the constructors and operator overloading.
4. To understand the concepts of inheritance, polymorphism and virtual function
5. To learn and define concept of templates and exception handling

Unit	Description	Instructional Hours
I	**BASICS OF 'C' PROGRAMMING** Fundamentals of ' C' programming – Structure of a 'C' program – Constants - Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations- Branching and Looping - Arrays – One dimensional and Two dimensional arrays. **Programs: 1. Write a C program to calculate sum of individual digits of a given number. 2. Write a C program to count no. of positive numbers, negative numbers and zeros in the array. 3. Write a C program to find sum of two numbers using functions with arguments and without return type.**	3+6(P)
II	**BASICS OF 'C++' PROGRAMMING** Introduction to C++ – structures and unions- Object oriented programming concepts–Defining a Class – creating objects - access specifiers – Function in C++ - function and data members default arguments – function overloading – Inline functions - friend functions – constant with class – static member of a class – nested classes – local classes. **Program: Write a C++ program to accept the student detail such as name and 3 different marks by get_data() method and display the name and average of marks using display() method. Define a friend class for calculating the average of marks using the method mark_avg().**	6+3(P)
III	**CONSTRUCTOR AND OPERATOR OVERLOADING** Constructors - Default, Copy, Parameterized, Dynamic constructors, Default argument – Destructor. - Function overloading- Operator overloading-Unary, Binary - Binary operators using friend function. **Program: Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere and hence implement the concept of Function Overloading.**	7+2(P)
IV	**INHERITANCE AND POLYMORPHISM** Inheritance – Public, Private and Protected derivations– Single– Multiple– Multilevel– Hybrid– Hierarchical - Virtual base class – abstract class – composite objects- Runtime polymorphism – virtual functions – pure virtual functions. **Program: Demonstrate Simple Inheritance concept by creating a base class FATHER with data members SurName and Bank Balance and creating a derived class SON, which inherits SurName and Bank Balance feature from base class but provides its own feature FirstName and DOB. Create and initialize F1 andS1 objects with appropriate constructors and display the Father & Son details. (Hint: While creating S1 object, call Father base class parameterized constructor through derived class by sending values).**	7+2(P)
V	**TEMPLATES AND EXCEPTION HANDLING** Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception. **Program: Write a C++ program to create a template function for Bubble Sort and demonstrate sorting of integers and doubles**	7+2(P)
	Total Instructional Hours	**30+15**

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Course Outcome	CO1: Able to develop simple applications in C using basic constructs. CO2: Able to apply solutions to real world problems using basic characteristics of C++. CO3: Able to write object-oriented programs using operator overloading, constructors and destructors. CO4: Able to develop programs with the concepts of inheritance and polymorphism. CO5: Able to understand and define solutions with C++ advanced features such as templates and exception handling.

TEXT BOOKS:

T1- E.Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2016.

T2- E.Balagurusamy, "Object Oriented Programming with C++", 7th Edition, McGraw Hill Publication, 2017.

REFERENCES BOOKS:

R1-Yashavant P. Kanetkar, "Let Us C", BPB Publications, 2011.

R2-RohitKhurana, "Object Oriented Programming with C++",Vikas Publishing, 2nd Edition, 2016.

R3- B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME2154	ENGINEERING GRAPHICS	1	0	4	3

Course Objective

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves	12
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes. Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	Total Instructional Hours	**60**

Course Outcome

Upon Completion of the course students can be able to

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.

CO2: Draw the orthogonal projections of straight lines and planes.

CO3: Interpret the projections of simple solid objects in plan and elevation.

CO4: Draw the projections of section of solids and development of surfaces of solids.

CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOKS:

T1-K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New delhi 2016.

T2- K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai.

REFERENCES BOOKS:

R1-Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited,New Delhi 2008.

R2-N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

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Programme	Course Code	Name of the Course	L	P	T	C
B.E.	19ME2001	ENGINEERING PRACTICES LABORATORY	0	0	4	2

Course Objective

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

GROUP A CIVIL AND MECHANICAL ENGINEERING PRACTICES

Exp.No.	Description of the Experiments
1.	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.
3.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.
4.	Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5.	Practice on sheet metal Models– Trays and funnels
6.	Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7.	Practice on simple step turning, taper turning and drilling.
8.	Demonstration on Smithy operation.
9.	Demonstration on Foundry operation.
10.	Demonstration on Power tools.

GROUP B ELECTRICAL ENGINEERING PRACTICES

Exp.No.	Description of the Experiments
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp wiring.
3.	Stair case wiring.
4.	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5.	Measurement of energy using single phase energy meter.
6.	Soldering practice using general purpose PCB.
7.	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8.	Study of Energy Efficient Equipment's and Measuring Instruments.

Total Practical Hours 45

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Course Outcome

At the end of the course the students shall be able to

CO1: Fabricate wooden components and pipe connections including plumbing works.

CO2: Fabricate simple weld joints.

CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II	0	0	2	1

(COMMON TO ALL BRANCHES)

Course Objective

- ✓ **To introduce to business communication.**
- ✓ **To train the students to react to different professional situations.**
- ✓ **To make the learner familiar with the managerial skills**
- ✓ **To empower the trainee in business writing skills.**
- ✓ **To learn to interpret and expertise different content.**

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	3
II	**Listening and Speaking-** listening to TED talks **Reading-** Making and interpretation of posters **Writing-** Business letters: letters giving good and bad news. Thank you letter. Congratulating someone on a success" **Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	3
IV	**Listening and Speaking-** Role play - **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	3
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company - **Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling & number rules).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Introduced to different modes and types of business communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to business writing.
CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS:

R1 - Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3- Frederick T. Wood, "Remedial English Grammar for Foreign Students", Macmillan publishers, 2001.

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SYLLABUS

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3106	NUMERICAL METHODS FOR ELECTRONICS ENGINEERS	3	1	0	4

Course Objective

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Understand the concepts of curve fitting, interpolation with equal and unequal intervals.
3. Be Familiar with the concepts of numerical differentiation and numerical integration of the unknown functions.
4. Understand the concept of solving ordinary differential equations by applying single and multi step methods.
5. Appraise the methods introduced in the solution of ordinary differential equations and partial differential equations.

Unit	Description	Instructional Hours
I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS** Solution of equation – Fixed point iteration : X = g(x) method – Newton Raphson method – Solution of linear system by Gauss Elilmination and Gauss Jordan method – Iterative method : Gauss seidel method.	12
II	**CURVE FITTING AND INTERPOLATION** Curve fitting - Method of least squares – Interpolation - Newton's forward and backward difference formulae – Lagrangian interpolation for unequal intervals – Newton's divided difference formula for unequal intervals.	12
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Differentiation using interpolation formula – Newton's forward and backward interpolation formulae for equal intervals –Newton's divided difference formula for unequal intervals - Numerical integration by Trapezoidal and Simpson's 1/3 rule – Romberg's method – Double integration using Trapezoidal and Simpson's rules	12
IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods: Taylor's series method – Euler and Modified Euler methods for first order equation – Fourth order Runge- kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method.	12
V	**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional Wave equation – Two dimensional Heat equations – Laplace and Poisson Equations.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Solve the system of linear algebraic equations representing steady state models and non linear equations arising in the field of engineering.
CO2: Fit the smooth curves for the given data and understand the application of interpolation with equal and unequal intervals.
CO3: Express the information from discrete data set through numerical differentiation and summary information through numerical integration.
CO4: Classify and solve ordinary differential equations by using single and multi step methods.
CO5: Acquire knowledge of finding the solution of ordinary and partial differential equations which are useful in attempting any engineering problems.

TEXT BOOKS:

T1 - Sankara Rao K, "Numerical Methods for Scientists and Engineers", 3rd edition, Prentice Hall of India Private limited, New Delhi,2007..
T2 - M.K.Jain,S.R.K.Iyengar, R.K.Jain "Numerical methods for Scientific and Computation", Fifth Edition, New Age International publishers 2010.

REFERENCE BOOKS :

R1 - Kreyszig.E. "Advanced Engineering Mathematics", Eight Edition, John Wiley and sons (Asia) limited.
R2 - Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2004.
R3 - S.K.Gupta, Numerical Methods for Engineers" , New Age Internationalm Pvt.Ltd Publishers,2015.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC3201	DIGITAL ELECTRONICS	3	0	0	3

Course Objective

1. Interpret the basic postulates of Boolean algebra and show the correlation between Boolean expressions and the methods for simplifying Boolean expressions.
2. Describe the formal procedures for the analysis and design of combinational circuits.
3. Examine the formal procedures for the analysis and design of sequential circuits.
4. Discuss the concept of memories and programmable logic devices.
5. Enumerate the concept of various integrated circuits technologies.

Unit	Description	Instructional Hours
I	**BOOLEAN ALGEBRA AND LOGIC SIMPLIFICATIONS** Boolean operation and expressions- Laws and rules of Boolean algebra -Simplification using Boolean algebra - Sum of Products (SOP) - Product of Sums (POS)- Karnaugh map Minimization- Quine - Mc Cluskey method of minimization- Logic Gates-Universal property of NAND-NOR Gates- NAND–NOR implementations.	9
II	**ANALYSIS AND DESIGN OF COMBINATIONAL LOGIC** Basic adders and subtractors-Parallel binary adder/Subtractor- Carry Look Ahead adder - Serial Adder/Subtractor - BCD adder -Comparator- Decoder - Encoder- Priority encoder - Code converters- Multiplexer / Demultiplexer- Parity checker and generators-ALU- Binary Multiplier - Binary Divider.	9
III	**ANALYSIS AND DESIGN OF SEQUENTIAL CIRCUITS** Latches- Flip-flops- SR, JK, D, T, and Master-Slave - Characteristic table and equation - Application table- Edge triggering - Level Triggering- Asynchronous or Ripple counter - Asynchronous Up/Down counter - Synchronous counters - Synchronous Up/Down counters- Design of Synchronous counters- Shift registers- Universal shift registers- Ring counter - Shift counters.	9
IV	**FSM AND MEMORIES** Finite State Machines-Moore and Mealy models, Semiconductor Memories- RAM-ROM - PROM - EPROM - Flash memories- Memory Expansion-Special types of memories.	9
V	**INTEGRATED CIRCUIT TECHNOLOGIES** Basics of digital integrated circuits-Operational characteristics and parameters-RTL-CMOS circuit-TTL circuit-Comparison of CMOS and TTL-ECL-PMOS-NMOS-E2CMOS-Tristate Logic-Introduction to Verilog with Basic programs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze the different methods used for simplification of Boolean expressions and implementation using gates.
CO2 :Design and test the performance of various combinational circuits.
CO3: Formulate the design procedure of synchronous counters.
CO4: Relate different memory cells and programmable logic devices.
CO5: Generalize the performance of various integrated circuits technologies.

TEXT BOOKS:

T1- Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
T2- M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS :

R1- A.Anand kumar, "Fundmentals of Digital Electronics", fourth edition ,PHI Learning Pvt. Ltd,2016.
R2- S.Salivahanan and S.Arivazhagan, "Digital Circuits and Design" ,Vikas publishing House Pvt. Ltd ,2013
R3- Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC3202	SIGNALS AND SYSTEMS	3	1	0	4

Course Objective

1. To understand the basic signals and their properties.
2. To learn the mathematical tool of Fourier series and transforms.
3. To understand the concept of system analysis using Laplace transform.
4. To understand the discrete signal analysis using transforms.
5. To know discrete system analysis using Z –transform.

Unit	Description	Instructional Hours
I	**SIGNALS AND SYSTEM REPRESENTATION & CLASSIFICATION** Standard signal representation –continous and discrete domain. Properties of impulse signal. Mathematical operation on signals, classification of signals and system -analog and discrete.	12
II	**ANALYSIS OF CONTINUOUS TIME SIGNALS** Fourier series analysis-spectrum of continuous time (CT) signals- Fourier and Laplace transforms in CT signal analysis - properties.	12
III	**LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS** Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in analysis of CT systems	12
IV	**ANALYSIS OF DISCRETE TIME SIGNALS** DTFT – properties of DTFT - z transform – properties of z transform, convolution sum.	12
V	**LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS** Block diagram representation - DTFT and Z transform analysis of systems.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Understand the signal classification and properties
CO2: Analyze the signal spectrum with Fourier series and transform.
CO3: Apply Fourier and Laplace transform in LTI system analysis.
CO4: Analyze Discrete signal using DTFT.
CO5: Apply Z-transform for discrete system analysis.

TEXT BOOKS:

T1 - Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2007.
T2 - P Ramakrishna Rao, "Signals and System", Tata McGraw-Hill Education.

REFERENCE BOOKS :

R1 - M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", McGraw Hill, 2007.
R2 - B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
R3 - Ramesh Babu.P and Anandanatarajan, "Signals and Systems",Fourth edition,Scitech publications.
R4 - A.Nagoor Kani, "Signals and Systems", McGrawHill Publication, 2010.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC3203	ELECTRONIC CIRCUITS	3	0	0	3

Course Objective

1. To introduce methods of biasing transistors.
2. To introduce the Midband analysis of amplifier circuits using small - signal equivalent circuits.
3. To analysis and design of wave shaping circuits and multivibrators.
4. To design and analysis of feedback amplifiers.
5. To analysis and design of low and high frequency oscillators.

Unit	Description	Instructional Hours
I	**BIASING OF BJT AND FET** Need for biasing – Stability factor - Load line and quiescent point. -Variation of quiescent point - BJT biasing circuits – Bias compensation for BJT – FET Biasing circuits.	9
II	**SMALL SIGNAL AMPLIFIERS** h-parameter small-signal equivalent circuit - Midband analysis of single stage BJT amplifiers - Low frequency response of BJT amplifiers - High frequency π model -High frequency response of BJT amplifiers, Multistage amplifiers -Darlington Amplifier.	9
III	**LARGE SIGNAL AMPLIFIERS AND LINEAR WAVE SHAPING CIRCUITS** Classification of large signal amplifiers –Class A , Class B amplifier – Cross over Distortion -Push-Pull amplifier – complementary symmetry push-pull amplifier, Tuned amplifiers -Class C tuned amplifier -Integrator- Differentiator- Clippers- Clampers- Diode comparator - Clampers.	9
IV	**FEEDBACK AMPLIFIERS** Block diagram, Loop gain, Gain with feedback, Effects of negative feedback. Sensitivity and desensitivity of gain, Cut-off frequencies, distortion, noise, input impedance and output impedance with feedback. Four types of negative feedback connections - voltage series feedback, voltage shunt feedback, current series feedback and current shunt feedback.	9
V	**OSCILLATORS AND MULTIVIBRATORS** Classification of oscillator, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude. General form of an Oscillator, Analysis of Hartley, Colpitt's, RC phase shift and Wien bridge Oscillator- Astable multivibrator - Monostable multivibrator, Pulse Shaping circuits.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the Midband analysis of amplifier circuits using small - signal equivalent circuits.
CO2: To analyze of LC and RC oscillators.
CO3: To understand the basic concepts of biasing transistors.
CO4: To analyze wave shaping circuits and multivibrators.
CO5: To design and analyze feedback amplifiers

TEXT BOOKS:

T1- S.Salivahanan, N.Suresh Kumar and A.Vallavaraj, "Electronic Devices and Circuits", 2 nd Edition,2008, McGraw Hill.
T2- David A. Bell, "Electronic Devices and Circuits", fifth edition,Oxford Higher education .
T3- Donald A Neamen, "Electronic Circuit Analysis and Design", McGraw Hill, 3rd Edition, 2003.

REFERENCE BOOKS :

R1- Robert L.Boylestad, Louis Nasheisky, "Electronic Devices and Circuit Theory", 9th Edition, 2007.
R2- Jacob Millman,Christos C.Halkias,"Electronic Devices and Circuits" Mc Graw Hill , Edition 1991.
R3- D.Schilling and C.Belove, "Electronic Circuits", 3rd Edition, Mc Graw Hill, 1989.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC3204	SEMICONDUCTOR FABRICATION TECHNOLOGY	3	0	0	3

Course Objective

1. To give an overview of key technological developments, basic fabrication steps and crystal growth.
2. To be familiar with the process of silicon oxidation and photolithography.
3. To learn the concepts of etching and diffusion.
4. To give an outline on ion implantation techniques and film deposition.
5. To illustrate the inter relationship between the major process steps used for IC.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Semiconductor materials, Semiconductor Devices, Semiconductor Process Technology: Key Semiconductor Technology , Basic Fabrication Steps, Crystal Growth: Silicon Crystal Growth from Melt: Starting Material, The Czochralski Technique, Distribution of Dopant, Silicon Float Zone Process, GaAs Crystal Growth Techniques-Material Characterization	9
II	**SILICON OXIDATION AND PHOTOLITHOGRAPHY** Thermal Oxidation Process, Impurity redistribution during oxidation, Masking properties of silicon dioxide-Oxide Quality, Oxide thickness Characterization, Optical Lithography, Next Generation Lithographic Methods.	9
III	**ETCHING AND DIFFUSION** Wet Chemical Etching: Silicon Etching, Silicon Dioxide Etching, Silicon Nitride and Polysilicon Etching, Aliminium Etching, Gallium Arsenide Etching, Dry etching: Plasma Fundamentals, Etch Mechanism, Reactive Plasma Etching-Applications, Basic Diffusion Process: Diffusion Equation, Diffusion Profiles, Equation of Diffused Layers, Extrinsic Diffusion: Concentration-Dependent Diffusivity, Diffusion Profiles, Lateral Diffusion.	9
IV	**ION IMPLANTATION AND FILM DEPOSITION** Range of Implanted Ions, Implant Damage and Annealing, Implantation Related Processes , Epitaxial Growth Techniques, Dielectric Deposition, Poly silicon Deposition, Metallization	9
V	**PROCESS INTEGRATION** Passive components-Integrated Circuit resistor, Integrated Circuit Capacitor, Integrated Circuit Inductor, Bipolar Technology-Basic Fabrication Process, MOSFET Technology-Basic Fabrication Process, MEMS Technology, System-on-a-Chip	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to understand the basic steps of fabrication and crystal growth.
CO2: Understand the concepts of silicon oxidation and photolithography.
CO3: Ability to explain the process of etching and diffusion.
CO4: Understand the basic process of ion implantation and film deposition.
CO5: Ability to understand the integrating process in fabrication of active and passive components in an IC.

TEXT BOOK:

T1- Gary S.May and Simon M.Sze, "Fundamental of Semiconductor Fabrication", Wiley, 2004.

REFERENCES BOOKS:

R1- Amar Mukherjee, "Introduction to NMOS and CMOS VLSI System design", Prentice Hall India.2000.
R2- Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", Prentice Hall India 2003.
R3- S.M.Sze, "VLSI Technology",Second Edition, Tata McGraw Hill.
R4- Wiley, Sorab.K.Ghandhi "VLSI Fabrication Principles",Second Edition, McGraw Hill.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16CS3231	DATA STRUCTURES AND ALGORITHMS	3	0	0	3

Course Objective

1. To understand the basics of Data Structures and Algorithms.
2. To understand the concepts of Linear Data Structures.
3. To understand the concepts of Non Linear Data Structures.
4. To comprehend the applications of Data structures.
5. To know the concepts of sorting and searching design the Programs using 'C' Language.

Unit	Description	Instructional Hours
I	**LINEAR DATA STRUCTURES- LIST** Introduction to data structures-algorithm analysis-Abstract Data Types-List ADT-Implementaion of List ADT-Array based Implementation-Linked List Implementation – Doubly Linked List-Circular Linked List-Applications of List.	9
II	**LINEAR DATA STRUCTURES- STACK AND QUEUE** Stack ADT-Implementation of Stack ADT(array,list)-Applications of Stack-Balancing Symbol--Expression Evaluation--Queue ADT- Implementation of Queue ADT(array,list)-Circular Queue Implementation-De-queue, Applications of Queue.	9
III	**NON LINEAR DATA STRUCTURES-TREE** Introduction to Trees-Tree Representation-Binary Tree-Applications of Tree-BST Implementation-Expression Tree -Tree Traversals-Height-Balanced Trees (Various operations on AVL Trees)	9
IV	**NON LINEAR DATA STRUCTURES-GRAPHS** Introduction to Graphs- Definitions – Breadth First Search -Depth First Search-Topological sort – Shortest-Path Algorithms(Dijikstra's algorithm) – minimum spanning tree – Prim's and Kruskal's algorithms – Floyd algorithm -Warshall's Algorithm - applications of graphs.	9
V	**SORTING, SEARCHING AND HASH TECHNIQUES** Sorting algorithms: Insertion sort -Selection sort -Shell sort -Bubble sort -Quick sort -Merge sort -Radix sort –Searching: Linear search –Binary Search .	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the concepts of Data structures and algorithms
CO2: Discuss the different methods of organizing large amount of data.
CO3: Comprehend the applications of Data structures.
CO4: Apply the different data structures for implementing solutions to practical problems.
CO5: Apply the concepts of sorting and searching techniques to solve the problems.

TEXT BOOKS

T1- Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, Addison-Wesley, 2007.
T2- A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCE BOOKS

R1- ISRD Group, "Data Structures using C", Tata McGraw-Hill Publishing Company Ltd., 2006.
R2- Robert L. Kruse, Clovis L. Tondo, Bruce P. Leung ,"Data structures and program design in C " ,2nd Edition, PHI.
R3- T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC3001	ELECTRONIC CIRCUITS LAB	0	0	4	2

Course Objective

1. To introduce methods of biasing transistors
2. To design and analysis of feedback amplifiers
3. To analyze and design wave shaping circuits and multivibrators
4. To analyze and design low and high frequency oscillators
5. To simulate various electronic circuits using multisim

Expt. No.	Description of the Experiments
1	Design, construct and test the following biasing circuits and find the transient analysis and frequency response of Single BJT and FET. a) Fixed bias b) Self bias
2	Darlington Amplifier
3	Current series ,Voltage shunt and voltage series feedback amplifiers
4	RC Phase shift oscillator.
5	Hartley Oscillator and Colpitts Oscillator.
6	Class C tuned Amplifier
7	Astable multivibrator and Monostable multivibrator
8	Integrator, Differentiator, Clipper and Clamper circuits
	Simulation experiments
9	Integrator ,Differentiator, Clipper and Clamper circuits.
10	Astable multivibrator and Monostable multivibrator .

Total Practical Hours **45**

Course Outcome

)1: Analyze and design different types of oscillators.
)2: To design different types of feedback amplifiers.
)3: To find applications for power amplifier .
)4: Design different types of Mutlivibrators.
)5: Analyze the performance of electronic circuits using PSPICE.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16CS3031	DATA STRUCTURES AND ALGORITHMS LAB	0	0	4	2

Course Objective

1. To teach efficient storage mechanisms of data for an easy access.
2. To design various basic and advanced data structures.
3. To implement various basic and advanced data structures.
4. To introduce various techniques for representation of the data in the real world.
5. To teach the concept of management of data.

Expt. No.	Description of the Experiments
1	Implementations of Linked Lists menu driven program
2	Implementations of stack menu driven program
3	Implementations of Infix to Postfix Transformation and its evaluation program
4	Implementations of circular queue menu driven program
5	Implementation of Priority queue program using array
6	Implementations of Binary Tree menu driven program
7	Implementation of construction of expression tree using postfix expression
8	Implementations of AVL Tree menu driven program
9	Implementations of Shell sort, Radix sort and Insertion sort menu driven program
10	Implementations of Graph menu driven program (DFS & BFS)
11	Implementations of Prim's and Kruskal's Algorithm
	Total Practical Hours 45

Course Outcome

CO1: To design and analyze the time and space efficiency of the data structure.
CO2: To develop application using data structures.
CO3: To design and analyze the time and space efficiency of the data structure.
CO4: To implement various sorting algorithms.
CO5:To identity the appropriate data structure for given problem.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4109	PROBABILITY AND RANDOM PROCESSES	3	1	0	4

Course Objectives

1. Construct a well defined knowledge of probability and random variables.
2. Understand the concept of standard distributions which can describe the real life phenomenon.
3. Know the concept of two dimensional random variables and determine covariance.
4. Understand the concept of stationary process and correlation functions.
5. Learn the power spectral density functions and recognize the concepts of linear system with random inputs.

Unit	Description	Instructional Hours
I	**PROBABILITY AND RANDOM VARIABLE** Definition - Axioms of Probability - Conditional Probability - Total Probability - Bayes Theorem (Proof excluded) - Random variable - Discrete and continuous random variables - Moment generating functions.	12
II	**STANDARD DISTRIBUTION** Discrete Distributions - Binomial, Poisson, Geometric distributions - Continuous Distributions - Uniform, Exponential and Normal distributions.	12
III	**TWO DIMENSIONAL RANDOM VARIABLES** Joint distributions – discrete and continuous random variables – marginal and conditional probability distributions – covariance – correlation.	12
IV	**RANDOM PROCESSES** Classification of Random Processes – Stationary process – Markov process - Poisson Process – Auto correlation functions – Cross correlation functions - Properties.	12
V	**SPECTRAL DENSITIES AND LINEAR SYSTEMS WITH RANDOM INPUTS** Power spectral density – Cross spectral density – Properties- Linear time invariant system – System transfer function – Linear systems with random inputs.	12
	Total Instructional Hours	**60**

Course Outcomes

)1: Understand the concepts of probability and random variables.
)2: Describe various discrete and continuous distribution functions.
)3: Understand and characterize phenomenon of two dimensional random variables.
CO4: Obtain a fundamental knowledge of the Markov and Poisson processes and acquire skills in analyzing correlation functions.
CO5: Apply the concept of Fourier Transform for finding power and cross spectral density functions and analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS:

T1 - Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2010
T2 - Veerarajan, T., "Probability, Statistics and Random Processes", Tata McGraw-Hill,2nd Edition, New Delhi, 2010.

REFERENCE BOOKS :

R1 – Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.
R2 - Stark. H. and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2008.
R3 - Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2nd Edition, 2014.
R4 - Cooper. G.R., Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", 3rd Indian Edition, Oxford University Press, New Delhi, 2007.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4201	ELECTRO MAGNETIC FIELDS	3	0	0	3

Course Objective

1. To analyze fields and potentials due to static changes
2. To evaluate static magnetic fields
3. To understand how materials affect electric and magnetic fields
4. To understand the relation between the fields under time varying situations
5. To understand principles of propagation of uniform plane waves.

Unit	Description	Instructional Hours
I	**STATIC ELECTRIC FIELD** Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density..	9
II	**STATIC MAGNETIC FIELD** The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I – Ampere's circuital law. Magnetic flux density – Force on a moving charge – Force on a differential current element – Torque on a closed circuit – Magnetic moment – Magnetic Potentials.	9
III	**ELECTRIC AND MAGNETIC FIELDS IN MATERIALS** Poisson's and Laplace's equation – Electric Polarization- Definition of Capacitance – Capacitance of various geometries using Laplace's equation – Electrostatic energy and energy density – Boundary conditions for electric fields –point form of ohm's law – continuity equation for current. Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance. Energy density in magnetic fields –magnetic boundary conditions.	9
IV	**TIME VARYING ELECTRIC AND MAGNETIC FIELDS** Faraday's law – Displacement current – Maxwell's equations in point form and integral form. Poynting Vector and the flow of power – Instantaneous Average and Complex Poynting Vector.	9
V	**ELECTROMAGNETIC WAVES** Derivation of Wave Equation – Uniform Plane Waves – Wave propagation in free space, dielectrics and in good conductors – Skin effect. Wave polarization – Reflection of Plane Wave from a conductor – normal incidence – Reflection of Plane Waves by a perfect dielectric – normal and oblique incidence.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Capable of analyzing fields and potentials due to static changes.
CO2: Ability to evaluate static magnetic fields.
CO3: Capability to understand how materials affect electric and magnetic fields.
CO4: Understanding the relation between the fields under time varying situations.
CO5: Understanding principles of propagation of uniform plane waves.

TEXT BOOKS

T1 - W H.Hayt & J A Buck : "Engineering Electromagnetics" McGraw-Hill, 7th Edition 2007.
T2 - E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Pearson Education/PHI, 4th Edition, 2006.

REFERENCE BOOKS

R1 - Matthew N.O.Sadiku: "Elements of Engineering Electromagnetics" Oxford University Press, 4th Ed,2007.
R2 - Narayana Rao, N : "Elements of Engineering Electromagnetics" 6th edition,Pearson Education, 2006.
R3 - Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics" ,John Wiley & Sons, 3rd edition 2003.
R4 - David K.Cheng: "Field and Wave Electromagnetics - Second Edition-Pearson,2004.
R5 - G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4202	CONTROL SYSTEMS	3	0	0	3

Course Objective

1. To know the concept of modeling of control systems.
2. To gain adequate knowledge in the time response analysis of first and second order systems.
3. To examine the various frequency response plots.
4. To enumerate the concept of different stability analysis techniques.
5. To describe the concept of state variable analysis.

Unit	Description	Instructional Hours
I	**MATHEMATICAL MODELING OF CONTROL SYSTEMS** Basic components of Control System – Open loop and Closed loop systems – Introduction to Differential equation -Transfer function- Modeling of Electrical and Mechanical systems- Block diagram reduction methods - Signal flow graph.	9
II	**TIME RESPONSE ANALYSIS** Time response - Order and Type of the Systems – Standard test signals-Unit step Response analysis of first and second order systems – Time domain specifications-Steady state errors – Introduction to P, PI, PD and PID controllers.	9
III	**FREQUENCY RESPONSE ANALYSIS** Frequency Response - Frequency Domain specifications -Bode Plot, Polar Plot - Constant M and N Circles – Nichols chart-Introduction to Lead, Lag, and Lead Lag Compensators.	9
IV	**STABILITY ANALYSIS** BIBO Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Application of Root Locus Diagram - Nyquist Stability Criterion.	9
V	**STATE VARIABLE ANALYSIS** State space representation of Continuous Time systems – State equations – Physical, Phase and Canonical variable forms-Transfer function from State Variable Representation – Properties of state transition matrix - Concepts of Controllability and Observability.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To analyze different control systems mathematically and graphically and understood the concept of Transfer Function.
CO2: To derive different time domain specifications and analyze the steady state error concept.
CO3: To design and analyze the polar, bode and Nichols frequency response plots.
CO4: To analyze the stability of closed loop system using different techniques.
CO5: To understand the concept of state space modeling of continuous time systems and controllability and observability.

TEXT BOOKS:

T1- J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
T2- Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

REFERENCES BOOKS:

R1- Katsushiko Ogata,"Modern control engineering",Pearson education,5th Edition, 2010.
R2- Schaum's Outline Series, "Feed back and Control Systems" ,Tata Mc Graw-Hill, 2007.
R3- A.Nagoor kani,"Control Systems Engineering",RBA publications, First edition,2010.
R4- John J.D Azzo & Constantine H.Houpis, "Linear Control System Analysis and Design", TMH ,1995.
R5- Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4203	MEASUREMENT AND INSTRUMENTATION	3	0	0	3

Course Objective

1. To know the concept of measurements and learn the use of DC and AC bridges for measuring R, L and C.
2. To learn the use of different types of transducers.
3. To learn the use of different types of function generators and analyzers.
4. To learn the working principle of digital instruments.
5. To learn the principle of working and applications of digital data acquisition system and fiber optic measurements.

Unit	Description	Instructional Hours
I	**MEASUREMENT CONCEPTS & INDICATING EQUIPMENTS** Principles of operation and construction of PMMC - Static and dynamic characteristics - types of errors-error analysis -moving coil, moving iron meters -multi meters -True RMS Meters -Bridge measurements -Maxwell, Kelvin and Wien bridge-Q meters.	9
II	**TRANSDUCERS** Classification of transducers-selecting a transducer -strain gauges-temperature transducer-LVDT Advantages and disadvantages-capacitive transducers-Piezo electric transducers and optoelectronic transducers, Measurement of Pressure, Temperature and velocity.	9
III	**FUNCTION GENERATORS AND ANALYZERS** Function generators-RF signal generators -Sweep generators -Frequency synthesizer -wave analyzer -Harmonic distortion analyzer -spectrum analyzer-heterodyne wave analyzer-frequency counters-time interval measurement-measurement of voltage, current, phase and frequency using CRO, DSO.	9
IV	**DIGITAL INSTRUMENTS** Comparison of analog and digital techniques - digital voltmeter - multimeters - frequency counters - measurement of frequency and time interval - extension of frequency range . Automation in digital instruments, Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments.	9
V	**DATA ACQUISITION SYSTEMS AND FIBER OPTIC MEASUREMENT** Elements of a digital data acquisition system - interfacing of transducers - multiplexing - data loggers -computer controlled instrumentation - IEEE 488 bus - fiber optic measurements for power and system loss - optical time domains reflectometer.	9
	Total Instructional Hours	**45**

Course Outcome

1:To understand the measurements concept and usage of AC/DC bridges.
2: To identify various types of transducers and their working.
3: To explain the different types of function generators and CRO.
4: To explore knowledge on Digital instruments.
5: To learn the various process of computer controlled instrumentation.

TEXT BOOKS:

T1 - B.C.Nakara, K.K.Chaudhry, Instrumentation Measurement and Analysis , McGraw - Hill , 2004.
T2 - Albert D.Helfrick and William D.Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI, 2003.

REFERENCE BOOKS :

R1 - Joseph J.Carr, Elements of Electronics Instrumentation and Measurement , PHI, 2003.
R2 - Alan. S. Morris, Principles of Measurements and Instrumentation , PHI, 2003.
R3 - A.K.Sawhney, "A Course In Electricl And Electronic Measurement And Instrumentation",Dhanpat Rai and Sons, fourth edition.
R4 - J.B.Gupta, "A Course In Electronics And Electrical Measurements And Instrumentation", S.K.Kataria and sons.2013.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4204	LINEAR INTEGRATED CIRCUITS	3	0	0	3

Course Objective

1. To introduce the basic concepts of OPAMP.
2. To impart knowledge on various applications of OPAMP.
3. To understand the working of comparators and waveform generators.
4. To learn the design concepts of ADC and DAC.
5. To understand the working of PLL and voltage regulators.

Unit	Description	Instructional Hours
I	**BASICS OF OPERATIONAL AMPLIFIERS** Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages, DC and AC performance characteristics, slew rate, Open and closed loop configurations.	9
II	**APPLICATIONS OF OPERATIONAL AMPLIFIERS** Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.	9
III	**COMPARATORS AND WAVEFORM GENERATORS** Comparators, Schmitt trigger, Sine-wave generators, Multivibrators . Triangular wave generator, Saw-tooth wave generator, Timer IC 555, Frequency to Voltage and Voltage to Frequency converters.	9
IV	**ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS** Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode -R - 2R Ladder types - switches for D/A converters, high speed sample and hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type .	9
V	**PLL AND VOLTAGE REGULATORS** Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation, Frequency synthesizing, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - SMPS.	9
	Total Instructional Hours	**45**

Course Outcome

1. To analyze the characteristics of opamp.
2. To design various applications of opamp.
3. To design various wave generating and shaping circuits.
4. To select ADC and DAC for various applications.
5. To design PLL and voltage regulators.

TEXT BOOKS:

T1 - D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 4th Edition ,New Age International Pvt. Ltd., 2010.
T2 - Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Pearson Education, 2015 .

REFERENCE BOOKS:

R1 - S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", 2nd edition McGraw Hill, 2014.
R2 - Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007.
R3 - Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
R4 - B.S.Sonde, "System design using Integrated Circuits" , 2nd Edition, New Age Pub, 2001.
R5 - Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2005.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16CS4232	OBJECT ORIENTED PROGRAMMING AND STRUCTURES	3	0	0	3

Course Objective

1. Introduce the basic concepts of OOP.
2. Describe the programming concepts in C++.
3. Discuss the basic concepts of JAVA.
4. Discuss about the programming in JAVA.
5. Discuss about the advanced concepts in JAVA.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO OOP** Object-Oriented Programming Concepts- Introduction to C++: Data Flow-Operators-Expressions-Control Flow- Arrays-Strings-Pointers and Functions.	9
II	**PROGRAMMING IN C++** Classes and Objects – Constructors and Destructors – Overloading – Inheritance – Polymorphism –Exception Handling-Templates	9
III	**INTRODUCTION TO JAVA** An overview of Java – Data Types – Variables and Arrays – Operators – Control Statements – Classes – Objects – Methods – Command Line Arguments	9
IV	**PROGRAMMING IN JAVA** Inheritance -Packages – Abstract classes – Interfaces and Inner classes – Exception handling	9
V	**ADVANCED CONCEPTS OF JAVA** String Handling-Multithreaded Programming-Streams and I/O-Applets	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the benefits of object oriented design and understand when it is an appropriate methodology to use.
CO2: Implement, test and debug solutions in C++.
CO3: Write, compile and execute Java programs.
CO4: use the Java programming language for various programming technologies
CO5: Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem

TEXT BOOKS:

T1- Deitel and Deitel, "C++ How to Program", Sixth Edition, Prentice Hall, 2007.
T2- Herbert Schildt, "Java The complete reference", Eighth Edition, McGraw Hill Professional, 2011

REFERENCE BOOKS:

R1- Balagurusamy E., "Object oriented programming with C++", Fifth Edition, Third Reprint, Tata McGraw–Hill Education 2011.
R2- Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition, Reprint 2004.
R3- Lippman S. B., Josee Lajoie, Barbara E. Moo, " C++ Primer ", Fourth Edition, Pearson Education, 2005.
R4- ISRD Group, "Introduction to Object–oriented programming through Java", Tata McGraw–Hill Publishing Company
Ltd., 2007.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4001	DIGITAL ELECTRONICS LAB	0	0	4	2

Course Objective

1. Demonstrate the formal procedures for the analysis and design of combinational circuits
2. Use appropriate design technique to design the different sequential circuits.
3. Apply the concepts of Hardware Description Language for designing digital circuits.

Expt.No	Description of the Experiments
1	Design and implement 4-bit binary Adder / Subtractor using IC 7483.
2	Design and implement BCD adder using IC 7483.
3	Design and implement Multiplexer and De-multiplexer using logic gates.
4	Design and implement Encoder and Decoder using logic gates.
5	Design and implement code converter
6	Design and construct a 4 – bit binary ripple counter.
7	Design and construct Modulo ripple counter.
8	Construct and test 3-bit synchronous up / down counter.
9	Construct and test 4 – bit shift register using Flip – flops.
10	Design and implement basic digital circuits programs using HDL.
	Total Instructional Hours **45**

Course Outcome

CO1: Analyze the performance of various combinational circuits.
CO2: Design and develop various synchronous counters.
CO3: Design and develop shift registers
CO4: Formulate the design procedure of combinational digital circuits using Hardware Description Language
CO5: Formulate the design procedure of sequential digital circuits using Hardware Description Language

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC4002	LINEAR INTEGRATED CIRCUITS LAB	0	0	4	2

Course Objective

1. To understand characteristics of operational amplifier.
2. To apply operational amplifiers in linear applications.
3. To apply operational amplifiers in nonlinear applications
4. To gain knowledge on generation of various waves.
5. To use SPICE software for circuit design.

Expt.No	Description of the Experiments
1	Design and Testing of Voltage Follower, Inverting & Non inverting amplifiers using 741 op-amp.
2	Design and Testing of Active low-pass, High-pass and band-pass filters using 741 op-amp.
3	Design and Testing of A stable multivibrator, Monostable multivibrator and Schmitt Trigger using 741 op-amp.
4	Design and Testing of Phase shift and Wien bridge oscillators using 741 op-amp.
5	Design and Testing of A stable and Monostable multivibrators using NE555 Timer.
6	Design Function Generator using ICL8038.
7	Simulate Integrator and Differentiator using SPICE.
8	Simulate A stable & Monostable multivibrators with NE555 Timer using SPICE.
9	Simulate Phase shift and Wien bridge oscillators with op-amp using SPICE.
10	Simulate D/A and A/D converters using SPICE.
	Total Instructional Hours **45**

Course Outcome

CO1: Design oscillators using operational amplifiers.
CO2: Design amplifiers using operational amplifiers.
CO3: Design filters using Op-amp and plot frequency response.
CO4: Analyse the performance of oscillators using SPICE.
CO5: Analyse the performance of multivibrators using SPICE

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SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5201	ANALOG COMMUNICATION	3	0	0	3

Course Objective

1. To understand Amplitude Modulation.
2. To gain knowledge about angle modulation systems.
3. To impart knowledge about Radio Transmitters.
4. To examine communication receivers.
5. To gain knowledge about different noises in communication systems.

Unit	Description	Instructional Hours
I	**AMPLITUDE MODULATION SYSTEMS:** Introduction - communication system model - Need for modulation - Amplitude Modulation -DSB-FC - Bandwidth Requirements- Power relations - Suppressed carrier systems - DSB-SC, SSB-SC - Generation and detection of DSB-FC waves - Square-Law Modulator, SquareLaw Detector, Envelope Detector - Generation and detection of DSB-SC waves - Balanced Modulator, Ring Modulator - Generation and detection of SSB-SC waves - Phase discrimination method - Comparison of AM systems.	9
II	**ANGLE MODULATION SYSTEMS:** Introduction to Angle Modulation - FM and PM - Narrow band FM and Wideband FM - Phasor representation of NBFM - Bandwidth requirements- Carson's Rule - Pre emphasis, De-emphasis - Generation and demodulation of FM waves -Indirect and Direct FM generation, Balanced Frequency Discriminator and PLL demodulator.	9
III	**TRANSMITTERS:** Classification of transmitters - Block diagram of AM broadcasting transmitters- Low Level and High Level transmitters - Pilot carrier technique - FM transmitters- Armstrong FM systems - Radio telemetry.	9
IV	**RECEIVERS:** Classifications of receivers - Block diagram - Receiver characteristics - Tuned radio frequency receiver - Super heterodyne receiver - Merits and demerits of different receivers. Block diagram of FM receiver -Automatic frequency control - Limiters - Diversity reception techniques - TDM and FDM.	9
V	**NOISE IN COMMUNICATION SYSTEMS:** Shot Noise - Thermal noise - White Noise- Noise Calculations - Equivalent Noise Bandwidth - Noise Figure - Effective Noise Temperature - Noise in CW Modulation systems, Noise in Linear Receiver using coherent detection, Noise in AM receivers using envelope Detection - Noise in FM receivers.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To differentiate various types of noise.
CO2: To design a Amplitude modulator and demodulator.
CO3: To design a Frequency modulator and demodulator.
CO4: To select appropriate Radio Transmitter.
CO5: To select appropriate Radio communication receivers.

TEXT BOOKS:

T1 - Simon Haykin, "Communication Systems", Wiley Publication, New Delhi, 2011.
T2 - P.Ramakrishna Rao, "Analog Communication", Tata McGraw Hill, New Delhi, 2011.

REFERENCE BOOKS :

R1 - Carlson A B, "Communication systems: An Introduction to signals and noise in electrical communication", McGraw Hill, New Delhi, 2002.
R2 - Dennis John, Roddy and Coolen, "Electronic Communications", Prentice Hall of India, New Delhi, 2003.
R3 - Taub and Schilling, "Principles of Communication Systems", McGraw Hill, New Delhi, 1996.
R4 - Lathi B P, "Introduction to Communication Systems", BS publications, New Delhi, 2001.
R5 - Kennedy G, "Electronic Communication systems", Tata McGraw Hill, New Delhi, 2009.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5202	DIGITAL SIGNAL PROCESSING	3	1	0	4

Course Objective

1. To learn discrete Fourier transform and its properties.
2. To know the characteristics of IIR and FIR filters.
3. To learn the design of infinite and finite impulse response filters for filtering undesired signals.
4. To understand Finite word length effects.
5. To study the concept of Multirate and adaptive filters.

Unit	Description	Instructional Hours
I	**DISCRETE FOURIER TRANSFORM** Discrete Signals and Systems- review – Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms, Inverse DFT using FFT – Fast Convolution.	12
II	**IIR FILTER DESIGN** Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.	12
III	**FIR FILTER DESIGN** Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Bartlett Window, Hamming Window, Hanning Window), Frequency sampling techniques.	12
IV	**FINITE WORDLENGTH EFFECTS** Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error - Overflow error – Round-off noise power - Limit cycle oscillations due to product round off and overflow errors – Principle of scaling	12
V	**DSP APPLICATIONS** Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply DFT for the analysis of digital signals & systems.
CO2: Able to design IIR and FIR filters.
CO3: Characterize finite Word length effect on filters.
CO4: Design the Multirate Filters.
CO5: Apply Adaptive Filters for equalization.

TEXT BOOKS:

T1 - John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
T2 - A .Nagoor Kani, "Digital Signal Processing", 2010 Edition,Mc Graw Hill Education (India) Pvt. Ltd.

REFERENCE BOOKS :

R1 - Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
R2 - Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Mc Graw Hill, 2007.
R3 - Andreas Antoniou, "Digital Signal Processing", Mc Graw Hill, 2006.
R4 - A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
R5 - A.Anandh kumar, "Digital Signal Processing", Prentice Hall,2014.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5203	DATA COMMUNICATION AND NETWORKS	3	0	2	4

Course Objective

1. To understand the state-of-the-art in network models
2. To analyze the flow control and error control algorithms in a network.
3. To familiarize the various aspects of routing algorithms.
4. Be exposed to the required functionality of each network application.
5. To familiarize with various wide area network.

Unit	Description	Instructional Hours
I	**PHYSICAL LAYER** OSI reference model . Line Configuration, Encoding and Decoding, Multiplexing-transmission media - Circuit Switching, Packet Switching, Message Switching.	9
II	**LINK LAYER ALGORITHMS AND PROTOCOLS** Flow control and error control, stop and wait, Sliding windows ,Local Area Networks - IEEE 802 standards, LLC, MAC layer protocols – CSMA/CD Ethernet, Token Ring,FDDI.	9
III	**ROUTING ALGORITHMS AND PROTOCOLS** Routing Algorithms- RIP, OSPF, BGP, multicast routing (DVMRP, PIM)- IPv4 -IPv6, TCP IP Protocol suite, congestion Control Algorithms	9
IV	**APPLICATION LAYER** Domain Name system – Remote logging, Electronic Mail, File Transfer - WWW and HTTP- Simple Network Management Protocol – Data Security.	9
V	**WIDE AREA NETWORKS** Integrated Services Digital Network (ISDN), *B-ISDN*, Frame delay and Asynchronous Transfer Mode (ATM) Protocol	9
	LIST OF EXPERIMENTS 1.Study And Compare the performance of Stop And Wait Protocol . 2.Study And Compare the performance of Selective Repeat Protocol,Go Back N Protocol, 3.Simulation of Network Topology – Star, Bus and Ring. 4..Simulation of Distance Vector Routing Algorithm, 5.Link State Routing Algorithm , 6. Study of Network Simulator (Ns) 7.Simulation of Congestion Control Algorithms Using Ns.	15
	Total Instructional Hours	**60**

Course Outcome

CO1: Demonstrate the networking strategies.
CO2: Identify the technical issues related to networking technologies.
CO3: Discriminate various routing techniques.
CO4: Illustrate the web applications
CO5: Implement various network algorithms and protocols.

TEXT BOOKS:

T1 - Behrouz A Forouzan , "Data Communication and Networking", McGraw-Hill, New Delhi, 2012.
T2 - Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

REFERENCES BOOKS:

R1 - Andrew S Tanenbaum, "Computer networks", Prentice Hall of India, New Delhi, 2010.
R2 - William Stallings, "Data and Computer Communication", Prentice Hall of India, New Delhi, 2007.
R3 - Keiser G E, "Local Area Networks", McGraw Hill, New Delhi, 2010.
R4 - Comer D E, "Internetworking with TCP/IP", Prentice Hall of India, New Delhi, 2006.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5204	MICROPROCESSORS AND MICROCONTROLLERS: CONCEPTS AND APPLICATIONS	3	0	0	3

Course Objective

1. Demonstrate the Architecture of 8086 microprocessor.
2. Interpret the system bus structure and Multi processor configuration of 8086 microprocessor.
3. Apply the design aspects of I/O and Memory Interfacing circuits.
4. Examine the Architecture of 8051 microcontroller
5. Practice the design aspect of interfacing circuits with 8051 microcontroller.

Unit	Description	Instructional Hours
I	**8086 MICROPROCESSOR** Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines.	9
II	**8086 SYSTEM BUS STRUCTURE AND MULTIPROCESSOR CONFIGURATIONS** Basic 8086 configurations – System bus timing –Bus Standards – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	9
III	**PERIPHERAL DEVICES AND THEIR INTERFACING** Address space portioning-Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface -D/A and A/D Interface - Timer - Keyboard /display controller – Interrupt controller – DMA controller	9
IV	**8051 MICROCONTROLLER** Over view of 8051 family-Architecture of 8051 –I/O Pins Ports Circuits and I/O Port Programming - Instruction set - Addressing modes - Assembly language programming.	9
V	**8051 MICROCONTROLLER INTERFACING WITH PERIPHERAL DEVICE** 8051 Timers Programming - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface-Interfacing with 8255- Stepper Motor Interfacing, Practical applications-Water level indicator and Zigbee interfacing.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Write Assembly Language programs using 8086 microprocessor.
CO2: Point out System Bus Structure and Multiprocessor Configuration.
CO3: Analyze the various peripheral devices interfacing with 8086 microprocessor.
CO4: Model and implement 8051 microcontroller based systems.
CO5: Experiment programs on 8051 microcontroller for interfacing various peripheral devices.

TEXT BOOKS:

T1 - Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
T2 - Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture,programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.

REFERENCE BOOKS :

R1 - Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC",Delmar Publishers, 2007.
R2 - Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware:,TMH, 2012.
R3 - B. Ram ," Micro processors and Micro controllers", 8th Edition, Dhanpat Rai Publications Pvt. Ltd., 2015.
R4 - Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson Education, 2011.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5205	TRANMISSION LINES AND WAVE GUIDES	3	1	0	4

Course Objective

1. To study the general behavior of transmission lines
2. To gain knowledge on high frequency transmission lines and its losses.
3. To give thorough understanding on impedance matching using smith chart.
4. To provide knowledge on basic characteristics of uniform plane waves and guided waves.
5. To impart knowledge on rectangular and circular waveguides.

Unit	Description	Instructional Hours
I	**TRANSMISSION LINE THEORY** General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Line not terminated in Z0 - Reflection coefficient - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.	12
II	**HIGH FREQUENCY TRANSMISSION LINES** Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.	12
III	**IMPEDANCE MATCHING IN HIGH FREQUENCY LINES** Impedance matching: Quarter wave transformer – One-Eighth waveline - the half waveline-Stub matching - Single stub matching - Double stub matching - Smith chart - Solutions of problems using Smith chart - Single stub matching using Smith chart.	12
IV	**UNIFORM PLANE WAVES AND GUIDED WAVES** Uniform plane waves, Wave propagation in a lossless medium, Wave propagation in a conducting medium, Conductors and Dielectrics: Wave propagation in good dielectrics - Wave propagation in a good conductor - Depth of penetration .Guided Waves: Waves between parallel planes, TE Waves, TM Waves, Characteristics of TE and TM waves, TEM waves, Velocities of propagation,	12
V	**WAVE GUIDES** Rectangular Wave Guides: General Solution, TM and TE Waves in Rectangular Guides, Impossibility of TEM waves in waveguides .Circular Wave Guides: Bessel Functions, Solution of field equations, TM and TE Waves in Circular Guides.	12
	Total Instructional Hours	**60**

Course Outcome

1. To identify the types of transmission lines
2. To analyze signal propagation at Radio frequencies.
3. To design stub matching using smith chart.
4. To explore the nature of uniform and guided wave propagation
5. To understand radiowave propagation in guided systems

TEXT BOOKS:

T1 - John D. Ryder, "Networks, Lines and Fields", 2nd Edition, Prentice Hall India, 2010.
T2 - E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.

REFERENCE BOOKS :

R1 - William H. Hayt and John A. Buck, "Engineering Electromagnetics" ,8th edition,Mc Graw-Hill Publishing Company Ltd, New Delhi, 2011.
R2 - David K. Cheng, "Field and Wave Electromagnetics", 2nd Edition, Pearson Education, Delhi, 2004.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5001	DIGITAL SIGNAL PROCESSING LABORATORY	0	0	4	2

Course Objective

1. To implement Linear Convolution.
2. To implement Circular Convolution
3. To study the architecture of DSP processor.
4. To implement FIR and IIR filters
5. To demonstrate Finite word length effect

Expt.No	Description of the Experiments
	MATLAB / EQUIVALENT SOFTWARE PACKAGE
1	Generation of sequences.
2	Linear and Circular convolutions.
3	Sampling theorem and aliasing effects
4	Spectrum Analysis using DFT
5	Design of FIR filters
6	Design of IIR filters
7	Design of Multirate filters
	DSP PROCESSOR BASED IMPLEMENTATION
8	Waveform generation
9	Linear and Circular convolutions.
10	FFT and Filter Implementation
	Total Instructional Hours **45**

Course Outcome

CO1: Carry out simulation of DSP systems
CO2: Demonstrate based implementation of DSP systems
CO3: Analyze Finite word length effect on DSP systems
CO4: Demonstrate the applications of FFT to DSP
CO5: Implement different filters for various applications of DSP

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC5002	MICROPROCESSORS AND MICROCONTROLLER LABORATORY	0	0	4	2

Course Objective

1. Demonstrate the 8086 kit ,its instruction set.
2. Write Assembly Language program.
3. Apply the programming concepts to 8051 Microcontroller
4. Use proper peripheral devices and interface to 8086 Microprocessor.
5. Use proper peripheral devices and interface 8051 Microcontroller.

Expt.No	Description of the Experiments
1	Basic arithmetic and Logical operations using 8086 and MASM
2	Code conversion and Matrix operations using 8086 and MASM
3	Sorting and Searching using 8086 and MASM
4	Key board and Display interface using 8086 .
5	Serial interface and Parallel interface using 8086.
6	Basic arithmetic and Logical operations using 8051
7	Code conversion using 8051
8	Traffic light controller using 8051
9	A/ D and D/A interface using 8051
10	Stepper motor control interface using 8051
	Total Instructional Hours 45

Course Outcome

CO1: Analyze the performance of 8086 programs for various types of inputs.
CO2: Analyze the performance of 8051 programs for various types of inputs.
CO3: Formulate the design logic of 8051 programs.
CO4: Develop industrial application using 8086 Microprocessor .
CO5: Develop industrial application using 8051 Microcontroller.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6201	VLSI DESIGN	3	0	0	3

Course Objective

1. To learn the basics of MOS circuits.
2. To learn the scaling of MOS circuits
3. To design arithmetic building blocks.
4. To learn techniques of CMOS testing
5. To learn the concepts of HDL

Unit	Description	Instructional Hours
I	**VLSI DESIGN METHODOLOGY AND ELECTRICAL PROPERTIES OF MOS TRANSISTOR** VLSI design Flow- Architectural design - Logical design - Physical design - Layout styles -Full custom - Semi custom approaches. NMOS and PMOS transistors- Threshold voltage - Threshold voltage equations - MOS device equations - Basic DC equations - Second order effects - MOS modules - Small signal DC characteristics	9
II	**INVERTERS AND LAYOUT DESIGN RULES:** nMOS inverter - Depletion mode and enhancement mode pull ups – Pseudo nMOS Inverter - CMOS inverter – Transfer Characteristics – Noise Margins- Sheet resistance - Area Capacitance - Inverter delay – Power Dissipation- Need For Low Power-Need for design rules - Mead Conway design rules for the silicon gate nMOS process - CMOS nWell/PWell design rules -Simple layout examples –NAND,NOR and CMOS inverter	9
III	**DESIGNING ARITHMETIC BUILDING BLOCKS** Data path circuits, Architectures for Ripple carry Adder, Carry look ahead adders, High speed adders, Accumulators, Multipliers, Barrel Shifters, speed and area tradeoff.	9
IV	**CMOS TESTING** Need for testing, manufacturing test principles, design strategies for testing, chip level test technique, system level test technique.	9
V	**VERILOG PROGRAMMING** Basic syntax- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements, Data flow modeling , structural gate level modeling , Behavioral modeling, Test bench codes , basic gate level verilog code of decoder, encoder, comparator and flip flops.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the basic properties of MOS circuits
CO2: Explain the basic properties of MOS Scaling
CO3: Design various arithmetic blocks .
CO4: Discuss the techniques of testing VLSI circuits.
CO5: Model the digital system using Hardware Description Language.

TEXTBOOKS:

T1 - Neil H E Weste and Kamran Eshranghian, "Principles of CMOS VLSI Design: A system Perspective", Addison Wesley, New Delhi, 2009.

T2 - Jan M Rabaey and Anantha Chandrakasan, "Digital Integrated Circuits- A Design Perspective", Prentice hall of India, New Delhi, 2006.

REFERENCES BOOKS:

R1 - Sung-Mo Kanga and Yusuf Leblebici, "CMOS Digital Integrated Circuits- Analysis and Design", Tata McGraw Hill, New Delhi, 2004.

R2 - Neil H E Weste and David money Haris, "CMOS VLSI Design: A circuits and systems Perspective", Addison Wesley, New Delhi, 2010.

R3 - Douglas A Pucknell and Kamran Eshranghian, "Basic VLSI Design", Prentice Hall of India, New Delhi, 2011.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6202	DIGITAL COMMUNICATIONS	3	0	0	3

Course Objective

1. To know the principles of sampling & quantization
2. To study the various waveform coding schemes
3. To learn the various baseband transmission schemes
4. To understand the various Band pass signaling schemes
5. To know the fundamentals of channel coding

Unit	Description	Instructional Hours
I	**PULSE MODULATION** Sampling Process-Aliasing-Natural Sampling-Flat Sampling-PAM-PWM-PPM-Bandwidth-Noise trade off-TDM	9
II	**WAVEFORM CODING** Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding - Threshold effect - Comparison of PCM, DPCM & DM	9
III	**BASEBAND TRANSMISSION** Properties of Line codes - Unipolar / Polar RZ & NRZ - Bipolar NRZ - Manchester- ISI - Nyquist criterion for distortionless transmission - Pulse shaping - Correlative coding - Mary schemes - Eye pattern - Equalization	9
IV	**PASSBAND TRANSMISSION** Introduction -Pass band Transmission model -Generation, detection, BER of Coherent BPSK, BFSK, DPSK & QPSK - QAM -Carrier Synchronization - Sructure of Non-coherent Receivers .	9
V	**ERROR CONTROL CODING** Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder , Turbo Codes.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design PCM systems
CO2: Design and implement base band transmission schemes
CO3: Design and implement band pass signaling schemes
CO4: Analyze the spectral characteristics of band pass signaling schemes and their noise performance
CO5: Design error control coding schemes

TEXT BOOKS:

T1 - S. Haykin, "Digital Communications", John Wiley, 2005
T2 - P.Ramakrishna Rao, "Digital Communications",Tata Mc Graw Hill Company,2011.

REFERENCE BOOKS:

R1 - B. Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2009
R2 - B.P.Lathi, "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.
R3 - H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006
R4 - J.G Proakis, "Digital Communication", 4th Edition, Mc Graw Hill Company, 2001.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6203	DIGITAL IMAGE PROCESSSING	3	0	0	3

Course Objective

1. To Learn digital image fundamentals
2. To know about image enhancement in both time and frequency domains.
3. To be familiar with and restoration and segmentation techniques
4. To know the widely used image compression algorithms and wavelet transform. .
5. To understand the image recognition concepts and image representation in the form of features.

Unit	Description	Instructional Hours
I	**DIGITAL IMAGE FUNDAMENTALS** Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.	9
II	**IMAGE ENHANCEMENT** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.	9
III	**IMAGE RESTORATION, SEGMENTATION AND MORPHOLOGICAL PROCESSING** Noise models – Mean Filters – Adaptive filters - Notch Filters – Inverse Filtering – Wiener filtering, Segmentation- Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation. Practical applications –process an image using various segmentation techniques.	9
IV	**IMAGE COMPRESSION AND WAVELETS** Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression (JPEG) – Lossy Predictive Coding – Compression Standards, Wavelets – Subb and coding – Multi-resolution expansions.	9
V	**IMAGE REPRESENTATION AND RECOGNITION** Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor - Regional Descriptors –Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain and relate the concepts of digital image fundamentals.
CO2: Enhance the image to a desired quality in both time and frequency domains.
CO3: Restore good quality images from the degraded one and Segment different aspects of the image
CO4: Apply various algorithms for image compression.
CO5: Represent the image with various features and recognize an image from its features.

TEXT BOOKS:

T1 - Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", Pearson Education Inc, Second Edition, 2004.
T2 - Annadurai and Shanmughalakshmi, "Fundamentals of Digital Image Processing',Pearson India,2006.

REFERENCES BOOKS:

R1 - Anil K- Jain, "Fundamentals of Digital Image Processing", Pearson/Prentice Hall of India,2002.
R2 - S.Jayaraman,S.Esakkirajan,T.Veerakumar, "Digital Image Processing", TMH New Delhi ,2009.
R3 - S.Sridhar, "Digital Image Processing", Oxford University Press Higher Education,2011.
R4 - William K Pratt, "Digital Image Processing", John Wiley, New York, 2002.
R5 - Kenneth R.Castleman,"Digital Image Processing",Pearson,2003.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6204	ANTENNA AND WAVE PROPOGATION	3	0	0	3

Course Objective

1. To provide an insight of the radiation phenomena
2. To analyze a thorough understanding of the radiation characteristics of different types of antennas
3. To design aperture antennas, slot antennas and antenna arrays
4. To construct special antennas such as frequency independent and modern antennas.
5. To create awareness about the different types of propagation of radio waves at different frequencies

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF RADIATION:** Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance, Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole, Folded dipole, Yagi array.	9
II	**APERTURE AND SLOT ANTENNAS:** Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas , Microstrip antennas – Radiation mechanism – Application , Numerical tool for antenna analysis	9
III	**ANTENNA ARRAYS:** N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Antenna synthesis-Binomial array	9
IV	**SPECIAL ANTENNAS:** Frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR	9
V	**PROPAGATION OF RADIO WAVES:** Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept, Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading , Multi hop propagation	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the various types of antennas and wave propagation
CO2: Write about the radiation from a current element.
CO3: Develop knowledge about slot antennas.
CO4: Analyze the antenna arrays, aperture antennas and special antennas such as frequency independent and broad band
CO5: Compare different types of propagation of radio waves at different frequencies

TEXT BOOKS:

T1 - John D Kraus, "Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2005.
T2 - K.D.Prasad, "Antenna and Wave propagation",Satya Prakashan publishers,2012

REFERENCES BOOKS:

R1 - Constantine.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006
R2 - Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition New Age International Publishers, 2006.
R3 - S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007.
R4 - Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
R5 - R.E.Collin,"Antennas and Radiowave Propagation", Mc Graw Hill 1985.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6001	ANALOG AND DIGITAL COMMUNICATION LABORATORY	0	0	4	2

Course Objective

1. To visualize the effects of sampling and TDM .
2. To understand the different modulation and demodulation schemes.
3. To have a clear understanding of the various modules in a communication link.

Expt.No	Description of the Experiments
1	AM Modulator and Demodulator
2	FM Modulator and Demodulator
3	Generation of PAM. PPM and PWM
4	Sampling and Time Division Multiplexing
5	ASK Modulator and Demodulator
6	Simulation of FSK schemes
7	Observation (simulation) of signal constellations of BPSK and QPSK
8	PLL characteristics.
9	Line coding schemes
10	Simulation of Communication Channel(AWGN).
	Total Instructional Hours **45**

Course Outcome

CO1: Analyze the performance of various modulation methods.
CO2: Analyze the performance of variousde modulation methods.
CO3: Design applications using PLL.
CO4: Able to design a communication channel.
CO5: Able to multiplex signals without aliasing effect.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6002	VLSI DESIGN LAB	0	0	4	2

Course Objective

1. To learn Hardware Descriptive Language (Verilog).
2. To learn fusing of logical modules on FPGAs .
3. To learn the fundamental principles of VLSI circuit design in digital and analog domain.

Expt.No.	Description of the Experiments
1	Write Verilog Code for the following circuits and their Test Bench for verification, do the initial timing verification and observe the waveform. 1. Basic logical gates. 2.8 bit adder. 3.Flip flop -RS, D and JK 4.4 bit up/down counter 5.multiplier minimum 4 bit
2	Synthesize and implement 8 bit adder, 4 bit up/down counter and multiplier (minimum 4 bit) in a FPGA.
3	Design an Inverter_using CMOS and complete the design flow mentioned below: i. Draw the schematic and verify the DC Analysis and Transient Analysis ii.Draw the Layout and verify the Design Rule Check and ERC iii. Check for Layout verses schematic iv. Extract RC and back annotate the same and verify the Design v. Verify for Time, Power and Area.
	Total Instructional Hours 45

Course Outcome

CO1: Write HDL code for basic as well as advanced digital integrated circuits.
CO2: Import the logic modules into FPGA Boards and Synthesize digital logics on FPGA
CO3: Design the layouts of Analog IC Blocks using EDA tools.
CO4: Simulate the layouts of Analog IC Blocks using EDA tools.
CO5: Extract the layouts of Analog IC Blocks using EDA tools.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC6801	MINI PROJECT	0	0	4	2

Course Objective

1. Exposing participants to the current practices of social and environment issues.
2. Introducing the concept of various current fields and tools/techniques for the design and development of solutions.
3. Building confidence and capability amongst the students for further research and field application.

S.NO.	Guidelines
1.	Students should select a problem which addresses some basic home, office or other real life applications.
2.	The electronic circuit for the selected problem should have at least 20 to 25 components.
3.	Students should understand testing of various components.
4.	Soldering of components should be carried out by students.
5.	Students should develop a necessary PCB for the circuit.
6.	Students should see that final circuit submitted by them is in working condition.
7.	20-25 pages report to be submitted by students.
8.	Group of maximum three/four students can be permitted to work on a single mini project.
9.	The mini project must have hardware part. The software part is optional.
10.	Department may arrange demonstration with poster presentation of all mini projects developed by the students at the end of semester.
11.	It is desirable that the electronic circuit/systems developed by the students have some novel features.

Course Outcome

CO1: Facilitating participants to the current practices of social and environment issues.
CO2: Familiarity with the concept of various current fields and tools/techniques for the design and development of solutions.
CO3: Developing confidence and capability amongst the students for further research and field application.

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Programme	Course code	PROFESSIONAL ELECTIVE Name of the Course	L	T	P	C
B.E.	16EC5301	ANALYSIS AND DESIGN OF DIGITAL INTEGRATED CIRCUITS	3	0	0	3

Course Objective

1. To understand the CMOS logic design concepts.
2. To learn the characteristics of dynamic circuits.
3. To understand organization and function of memories.
4. To gain knowledge on the constituents of I/O circuits
5. To know importance of testing circuits.

Unit	Description	Instructional Hours
I	**COMBINATIONAL AND SEQUENTIAL MOS LOGIC CIRCUITS** Combinational circuits : CMOS logic circuits- Complex logic circuits - CMOS transmission gates Sequential logic gates : Behavior of bistable elements, the SR latch circuit, clocked latch and flip-flop circuits, CMOS D latch and edge triggered circuit	9
II	**DYNAMIC LOGIC CIRCUITS** Pass transistor circuits – Voltage bootstrapping – Synchronous dynamic circuits- High performance dynamic CMOS circuits.	9
III	**SEMICONDUCTOR MEMORIES** Read-only memory circuits (ROM), static read – write memory (SRAM) circuits, dynamic read – Write memory (DRAM) circuits- Access times in digital memories.	9
IV	**CHIP INPUT / OUTPUT CIRCUIT AND INTERCONNECTS** ESD protection , input circuits, output circuits and noise, on-chip clock generation and distribution, latch-up and its prevention. Interconnects –Resistance, capacitance and inductance effect-Models and problems in interconnects	9
V	**DESIGN FOR TESTABILITY** Fault types and models, controllability and observability-Ad hoc testable design techniques, scan based techniques, Built – In Self Test (BIST) techniques, current monitoring test.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe the combinational and sequential circuit using cmos gates
CO2: Design and select a suitable memory element as per requirement.
CO3: Analyse the effect of passive elements in interconnects.
CO4: Apply the concept of voltage bootstrapping in dynamic circuit design.
CO5: Apply suitable testing technique for integrated circuit analysis.

TEXT BOOKS:

T1- Sung-Mo Kang , Yusuf Leblebici , CMOS Digital Integrated Circuits Analysis and Design , Third Edition, Tata McGraw Hill Publications, 2003.
T2- John E.Ayers, Digital Integrated Circuits Analysis and Design, CRC Press-2004.

REFERENCE BOOKS

R1- David Hodges, Horace Jackson, Resve Saleh , Analysis and Design of Digital Integrated Circuits, Third Edition, McGraw Hill Companies, Incorporated , 2003.
R2- Rabaey, Jan, Anantha Chandrakasan, Bora Nikolic, "*Digital Integrated Circuits: A Design Perspective*", 2nd Edition, Prentice Hall, 2002.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC5302	COMPUTER ARCHITECTURE AND ORGANIZATION	3	0	0	3

Course Objective

1. To demonstrate the basic structure and operation of digital computer
2. To differentiate the operation of the arithmetic and logical operation using fixed-point and floating-point
3. To illustrate the different types of control and the concept of pipelining
4. To interpret the hierarchical memory system including cache memories and virtual memory.
5. To relate the different ways of communication with I/O devices and standard I/O interfaces

Unit	Description	Instructional Hours
I	**INTRODUCTION** Computing and Computers, Evolution of Computers, VLSI Era, System Design- Register Level, Processor Level, CPU Organization, Data Representation, Fixed – Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types, Addressing modes.	9
II	**DATA PATH DESIGN** Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, Booth's algorithm, non-restoring division algorithm, Floating Point Arithmetic, Coprocessor, Pipeline Processing, Pipeline Design, Modified Booth's Algorithm.	9
III	**CONTROL DESIGN** Hardwired Control, Microprogrammed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, Superscalar Processing, Nano Programming.	9
IV	**MEMORY ORGANIZATION** Random Access Memories, Serial - Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory.	9
V	**SYSTEM ORGANIZATION** Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, Vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, multiprocessors, fault tolerance, RISC and CISC processors, Superscalar and Vector processor.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Point out the major components of a computer including CPU, memory, I/O and storage.
CO2: Relate the operation carried out in fixed-point and floating-point Arithmetic.
CO3: Demonstrate the concept of pipelining
CO4: Point out the use of memory device for a system..
CO5: Apply the principles in design of RISC and CISC Processor.
CO6:

TEXT BOOKS:

T1- Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000

T2- V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation",TMH 1996.

REFERENCE BOOKS

R1- John P.Hayes, "Computer architecture and Organisation", Tata McGraw-Hill, Third edition, 1998

R2 - Paraami, "Computer Architecture", BEH R002, Oxford Press.

R3 - P.Pal Chaudhuri, , "Computer organization and design", 2nd Ed., Prentice Hall of India, 2007.

R4 - G.Kane & J.Heinrich, ""MIPS RISC Architecture", Englewood cliffs, New Jersey,Prentice Hall, 1992

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC5303	MEDICAL ELECTRONICS	3	0	0	3

Course Objective

1. To study the generation of bio-potentials, its representation and recording.
2. To gain knowledge about electrical and non-electrical parameters measurement.
3. To study the various therapeutic devices used in the hospitals.
4. To impart knowledge on the equipments used for physical medicine
5. To know about modern medical imaging tools.

Unit	Description	Instructional Hours
I	**ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING** The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.	9
II	**BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT**: pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters	9
III	**THERAPEUTIC DEVICES:** Need for Cardiac pacemakers- Implantable Pacemaker, DC Defibrillator, Dialyser- Parallel flow dialyser, performance analysis of dialyser - Heart lung machine.	9
IV	**PHYSICAL MEDICINE AND BIOTELEMETRY** Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill.	9
V	**MODERN IMAGING SYSTEM** X-ray Machine - Computed Tomography - Principles of NMRI imaging system – Medical ultrasound - Biological effects of Ultrasound – Medical thermograph.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To identify bio signals and their acquisition
CO2: To perform Bio medical and non electrical parameter measurement.
CO3: To understand the concepts of therapeutic devices and bio telemetry
CO4: To learn the concepts of Radiological Equipments ,
CO5: To apply medical science and engineering concepts to solve problems at t the various stages of measurement of human variables.

TEXT BOOKS:

T1 - Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003.
T2 - Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

REFERENCE BOOKS:

R1 - John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007
R2 - Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC5304	PRINCIPLES OF MANAGEMENT	3	0	0	3

Course Objective

1. To introduce the Evolution of Management and organization culture.
2. To gain knowledge on planning and Decision making.
3. To identify the functional types of organization.
4. To impart knowledge on motivational techniques and process of communication for effective management.
5. To understand the various process of controlling aspects of management.

Unit	Description	Instructional Hours
I	**MANAGEMENT AND ORGANIZATIONS CULTURE** Management Definition – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Levels in Management- Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises, Section 8 Company - Organization culture and Environment.	9
II	**PLANNING & DECISION MAKING** Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.	9
III	**NATURE OF ORGANISATION** Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning.	9
IV	**DIRECTING** Foundations of individual and group behavior – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment, Types and theories of leadership– Process of communication, Barrier in communication, effective communication.	9
V	**CONTROLLING** System and process of controlling – Budgetary and non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To understand the Levels of Management and organization culture.
CO2: To identify various planning process.
CO3: To explain the different types and structure of organization.
CO4: To explore knowledge on techniques and process of communication for effective management.
CO5: To learn the various process of controlling aspects of management.

TEXT BOOKS:

T1 - Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
T2 - Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

REFERENCE BOOKS:

R1 - JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
R2 - Koontz, H. and Weihrich, H., Essentials of Management: An International Perspective, 8th Edition, Tata McGraw Hill Education Private Ltd., July 2009.
R3 - Stephen P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC5305	PROFESSIONAL ETHICS	3	0	0	3

Course Objective

1. To create an awareness on Human Values and its components
2. To educate the value of Engineering Ethics
3. To inculcate the social responsibility of an engineer.
4. To impart knowledge on issues related to safety, responsibility and rights
5. To educate on professional practice on global issues

Unit	Description	Instructional Hours
I	**HUMAN VALUES** Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character– Spirituality	9
II	**ENGINEERING ETHICS** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.	9
III	**ENGINEERING AS SOCIAL EXPERIMENTATION:** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	9
IV	**SAFETY, RESPONSIBILITIES AND RIGHTS** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.	9
V	**GLOBAL ISSUES** Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility	9
	Total Instructional Hours	**45**

Course Outcomes

CO1: Understand the importance of various components of human values
CO2: Apply ethics in society,
CO3: Discuss the ethical issues related to engineering and
CO4: Realize the responsibilities and rights in the society
CO5: Apply professional ethics in solving global issues

TEXT BOOKS:

T1 - Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata Mc Graw Hill, New Delhi, 2003.
T2 - Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES BOOKS:

R1 - Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
R2 - John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
R3 - Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC5306	TV AND VIDEO ENGINEERING	3	0	0	3

Course Objective

1. Generalize the TV Pictures, Composite Video Signal, Picture Tubes and Camera Tubes
2. Interpret the principles of Monochrome Television Transmitter and Receiver systems
3. Collect the information about the essentials of colour television systems
4. Compare the various Color Television systems with a greater emphasis on PAL system
5. Explain the advanced topics in Television systems and Video Engineering

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF TELEVISION:** Aspect ratio-Image continuity-Interlaced scanning-Camera tubes-Image Orthicon-Vidicon-Plumbicon- Silicon Diode Array Vidicon- Solid-state Image scanners- Monochrome picture tubes- Composite video signal- Horizontal sync. Composition-vertical sync. details- Scanning sequence details. - VSB transmission.	9
II	**MONOCHROME TELEVISION TRANSMITTER AND RECEIVER:** TV transmitter-TV signal Propagation- Interference- TV Transmission Antennas-Monochrome TV receiver- RF tuner- UHF, VHF tuner-Digital tuning techniques-AFT-IFsubsystems-AGC-Video and Sound inter-carrier detection- DC re-insertion-Video amplifier circuits-Typical sync processing circuits-Deflection oscillators- Frame deflection circuits- Line deflection circuits-EHT generation-Receiver antennas.	9
III	**ESSENTIALS OF COLOUR TELEVISION:** Compatibility- Colour perception-Three colour theory- Luminance, Hue and saturation-Colour television cameras-Colour television display tubes-Delta-gun, Precision-in-line and Trinitron colour picture tubes-Purity and convergence- Pincushion-correction techniques-Automatic degaussing circuit- Modulation of colour difference signals.	9
IV	**COLOUR TELEVISION SYSTEMS:** NTSC colour TV systems-SECAM system- PAL colour TV systems- PAL-D Colour system-PAL coder-PAL-Decoder receiver-separation of U and V signals-Burst phase Discriminator-ACC amplifier-Ident and colour killer circuits-U and V demodulators- Colour signal matrixing. Sound in TV	9
V	**ADVANCED TELEVISION SYSTEMS:** Satellite TV technology-Domestic Broadcast System-Cable TV- Video Recording-VCR Electronics-Video Disc recording and playback-DVD Players-Tele Text Signal coding and broadcast receiver- Digital television-Transmission and reception –Projection television-Flat panel display TV receivers-LCD and Plasma screen receivers-3DTV-EDTV	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Evaluate the composite video signal and video signal dimensions
CO2: Describe the block diagram of Monochrome Television Transmitter and Receiver systems
CO3: Discriminate the various colour picture tubes
CO4: Assemble the different colour television systems
CO5: Summarize the advanced topics in Television systems and Video Engineering

TEXT BOOKS:

T1 - R.R.Gulati, "Monochrome Television Practice, Principles, Technology and servicing.", Third Edition 2006, New Age International (P) Publishers.

T2 - A.M Dhake, "Television and Video Engineering", 2nd ed., TMH, 2003.

REFERENCE BOOK:

R1 - R.P.Bali, Color Television, Theory and Practice, Tata McGraw-Hill, 1994.

R2 - Geoffrey H.Huston, Color Television Theory, McGraw-Hill.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6301	ADVANCED MICROPROCESSORS	3	0	0	3

Course Objective

1. To introduce the concepts of advanced microprocessors.
2. To understand the programming techniques using MASM, DOS and BIOS functions.
3. To impart knowledge about Pentium processors.
4. To introduce the concept of RISC-I And RISC –II microprocessors.
5. To introduce the concepts and architecture of ARM processor.

Unit	Description	Instructional Hours
I	**80186,80286,80386 AND 80486 MICROPROCESSORS** 80186 Architecture, Enhancements of 80186 – 80286 Architecture – Real and Virtual Addressing Modes – 80386 Architecture – Special Registers – Memory Management – Memory Paging Mechanism – 80486 Architecture – Enhancements – Cache Memory Techniques – Exception Handling – Comparison of Microprocessors(8086 – 80186 –80286 – 80386 – 80486).	9
II	**PENTIUM MICROPROCESSORS** Pentium Microprocessor Architecture – Special Pentium Registers – Pentium Memory Management – New Pentium Instructions – Pentium Pro Microprocessor Architecture – Special features – Pentium II Microprocessor Architecture – Pentium III Microprocessor Architecture – Pentium III Architecture – Pentium IV Architecture – Comparison of Pentium Processors.	9
III	**INTRODUCTION TO ARM PROCESSOR** Need of Advance microprocessors, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM Processor family, Development of ARM architecture.	9
IV	**RISC PROCESSORS I** PowerPC620 – Instruction fetching – Branch Prediction – Fetching – Speculation, Instruction dispatching – dispatch stalls – Instruction Execution – Issue stalls- Execution Parallelism – Instruction completion – Basics of P6 micro architecture – Pipelining – our- of-order core pipeline – Memory subsystem	9
V	**RISC PROCESSORS II** Intel i960 – Intel IA32- MIPS R8000 – MIPS R10000 – Motorola 88110 – Ultra SPARC processor- SPARC version 8 – SPARC version 9.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the various types of advanced processor
CO2: Ability to analysis abot the processor and memory managent
CO3: Develop knowledge about Pentium processor.
CO4: Analyze and study about RISC processor family
CO5: Ability to differentiate CISC and RISC design philosophy

TEXT BOOKS:

T1 - B.B.Brey, " The Intel Microprocessor 8086/8088 /80186/80188, 80286, 80386, 80486, PENTIUM, PENTIUM Pro, PII, PIII & IV Archietecture, Programming & Interfacing", Pearson Education ,2004.
T2 - John Paul Shen, Mikko H.Lipasti, "Modern Processor Design", Tata McGraw Hill ,2006

REFERENCE BOOKS:

R1 - Douglas V.Hall, "Microprocessors and Interfacing", Tata McGraw Hill,II Edition,2006
R2 - Mohamed Rafiquzzaman, "Microprocessors and Microcomputer Based System Design", II Edition, CRC Press, 2007.
R3 - Walter A Triebel and Avtar Singh , "The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications", Fourth Edition, Pearson Education.
R4 - Andrew N. Sloss, Dominic Symes, Chris Weight , "Arm System Developer's Guide, Designing and Optimizing Software", Elsevier.
R5 - Steve Furber , "Arm System-on-chip Architecture", 2nd Edition, Pearson publication.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6302	CLOUD COMPUTING	3	0	0	3

Course Objectives

1. Introduce the broad perceptive of cloud architecture and model
2. Explain the cloud computing technologies and its various forms of services
3. Gain knowledge on the concept of virtualization
4. Gain knowledge on the fundamental to cloud computing.
5. Understand the security issues in the cloud environment.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO CLOUD:** Cloud Computing Definition– History of Cloud Computing – Cloud Architecture – Characteristics- Cloud Storage — Advantages of Cloud Computing – Disadvantages of Cloud Computing – Cloud Services.	9
II	**DEVELOPING CLOUD SERVICES**: Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds	9
III	**CLOUD TECHNOLOGIES**: Web services. AJAX and Mashups. Virtualization Technology – Multi-tenant software- Understanding service oriented architecture – Moving application to cloud – Communicating with the cloud	9
IV	**VIRTUALIZATION:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization -I/O Virtualization - Memory Virtualization - Processor Virtualization (x86) – Virtual Machines: Xen , KVM, VmWare, VirtualBox	9
V	**CLOUD SECURITY, STANDARDS AND APPLICATIONS**: Security Concerns, Risk Issues and Legal Aspects – Data Security Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud	9
	Total Instructional Hours	**45**

Course Outcomes

CO1: Compare the strengths and limitations of cloud computing.
CO2: Identify the architecture, infrastructure and delivery models of cloud computing.
CO3: To differentiate the different types of cloud technologies.
CO4: Apply the concept of virtualization.
CO5: Apply the security models in the cloud environment

TEXT BOOKS:

T1- Dr Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge University Press, USA, 2010.

T2- Michael Miller, " Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.

REFERENCE BOOKS:

R1 - Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pvt Limited, July 2008.

R2 - Rittinghouse John W, Ransome James F, "Cloud Computing-Implementation, Management and Security", CRC Press, Taylor and Francis Group, 2012.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6303	NETWORK SECURITY	3	0	0	3

Course Objective

1. Analyze the Network security services, attacks and mechanisms.
2. Understand the applications of block ciphers and stream ciphers
3. Analyze the public key cryptography and the authentication techniques.
4. Interpret the Data Integrity algorithms and the methods used for key distribution
5. Analyze the security services provided to internet.

Unit	Description	Instructional Hours
I	**INTRODUCTION** OSI security architecture –Security Services, Mechanisms and attacks-Network security model-Symmetric cipher model- substitution techniques, transposition techniques, steganography.	9
II	**SYMMETRIC CIPHERS** Block cipher principles- Data Encryption Standard(DES)-Advanced Encryption Standard (AES)-Multiple Encryption-Triple DES- modes of block cipher-stream ciphers-RC5 algorithm.	9
III	**ASYMMETRIC CIPHERS** Principles of public key cryptosystems-RSA algorithm-Key management – Diffie Hellman Key exchange- EI Gamal cryptography-Elliptic curve arithmetic-Elliptic curve cryptography.	9
IV	**MUTUAL TRUST , AUTHENTICATION AND DATA INTEGRITY** Mutual trust, Symmetric key distribution using symmetric encryption-symmetric key distribution using asymmetric encryption-distribution of public keys- X.509 Authentication services-Remote user- Authentication principles-Kerberos, Data integrity : Security of hash function and MAC –SHA - HMAC –DSS .	9
V	**INTERNET SECURITY:** Security Services for E-mail-Pretty Good Privacy-S/MIME. Overview of IP Security – IP security policy-Encapsulation Security Payload (ESP)-SSL/TLS Basic Protocol-combining security associations-Internet key exchange.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze and apply the appropriate Cryptographic technique to overcome the security attacks.
CO2: Categorize Symmetric and asymmetric ciphers .
CO3: Develop Symmetric and asymmetric ciphers.
CO4: Develop a secured system with authentication and integrity services.
CO5: Apply the necessary internet security algorithm

TEXT BOOKS:

T1- William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013.
T2- Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.

REFERENCE BOOKS :

R1 - Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security ", Prentice Hall of India, 2002.
R2 - Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6304	OPERATING SYSTEMS	3	0	0	3

Course Objective

1. Describe the structure and functions of OS.
2. Outline the Process Management, Threads and Scheduling algorithms.
3. Generalized the principles of Memory allocation and storage management schemes..
4. Infer the file system and mass storage structure.
5. Demonstrate the Distributed operating system and I/O system

Unit	Description	Instructional Hours
I	**OPERATING SYSTEMS OVERVIEW** Operating system overview-Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.	9
II	**PROCESS MANAGEMENT** Processes-Process Concept, Process Scheduling, Operations on Processes, Interposes Communication; Threads- Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.	9
III	**STORAGE MANAGEMENT** Main Memory-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.	9
IV	**FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE** Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage- File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Allocation Methods, Free Space Management..	9
V	**I/O SYSTEMS AND DISTRIBUTED OPERATING SYSTEMS** I/O Systems, Distributed Systems –Distributed operating systems –Distributed file systems – Distributed Synchronization.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Discuss the operating system structure and system functions
CO2: Indentify the critical section problem, CPU scheduling and Dead Locks.
CO3: Explain the principles of memory allocation, segmentation and paging.
CO4: Distinguish between file structure and directory structure .
CO5: Interpret I/O Systems and Distributed Systems.

TEXT BOOKS:

T1- Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9thEdition, John Wiley and Sons Inc., 2012.
T2- Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

REFERENCE BOOKS :

R1 - William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall,2011.
R2 - Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
R3 - D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
R4 - http://nptel.ac.in/.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6305	PCB DESIGN	3	0	0	3

Course Objective

1. To describe the basics, layout planning and design in the field of Printed Circuit boards
2. To design the PCB deals with the various considerations for special circuits.
3. To learn the Image Transfer, Plating and Etching techniques.
4. To know the different technology involves in the Printed Circuit Boards
5. To summarize the PCB Technology trends.

Unit	Description	Instructional Hours
I	**BASICS OF PRINTER CIRCUIT BOARDS**: Component of a PCB – Classification of PCB - Manufacturing of Basic PCB – Layout planning : General PCB considerations – Layout Approaches – Standards : Mechanical Design Considerations - Electrical Design Considerations –Layout Design : Grid Systems - Layout Scale – Layout Sketch / Design – Layout considerations.	9
II	**DESIGN CONSIDERATIONS FOR SPECIAL CIRCUITS** Design Rules for Analog Circuits : Components and Placement – Signal Conductors – Supply and Ground Connectors – General Rules for design of Analog PCBs. Design Rules for Digital Circuits : Transmission Lines - Problems in Design of PCBs for digital circuits. Design rules for PCBs for High frequency circuits, Fast Pulse Circuits . Microwave Circuits and Power Electronic Circuits.	9
III	**IMAGE TRANSFER, PLATING AND ETCHING TECHNIQUES** Image Transfer Techniques: Laminates Surface Preparation – Screen Printing – Pattern Transferring Techniques – Printing Links – Printing Process - Photo Painting - Laser Diode Imaging(LDI) - Plating Process : need for Plating – Plating Techniques – General Problems in Plating - Special plating Techniques - Etching Techniques : Etching Arrangements - Etching Parameters – Equipment and Techniques - Optimizing Etchant Economy	9
IV	**TECHNOLOGY OF PRINTED CIRCUIT BOARDS** Film Master Production: Emulsion Parameters – Film Emulsions – Dimensional Stability of Film Masters – Reprographic Cameras– - – Film Processing - Film Registration - Photo printing : Basic processes for Double sided PCBs – Wet Film resists and Dry Film resists.	9
V	**PCB TECHNOLOGY TRENDS** Fine–line Conductors with Ultra–Thin copper Foil - Multilayer Boards - Multiwire Boards – Subtractive-Additive processes - Semi-Additive Processes – Additive Processes – Flexible Printed Circuit Boards – Metal Core Circuit Boards – Mechnaical Milling of PCBs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the basics PCB and layout design considerations.
CO2: Enumerate PCB Design considerations in Special circuits.
CO3: Enhance the knowledge in image transfer, plating and Etching techniques in PCBs.
CO4: Recognize the various Technology in Printed Circuit boards.
CO5: Summarize the PCB technology trends.

TEXT BOOKS:

T1- Walter C Bosshart, "Printed Circuits Boards Design and Technology" - Tata McGraw- Hill , 2008
T2- R.S. Khandpur, "Printed Circuit Boards Design, Fabrication, Assemble and Testing", TMH, 2005.

REFERENCE BOOKS:

R1- Christoper T.Robertson, " PCB Designers Referennce : Basics" - Prentice Hall, First edition , 2003.
R2- C.F.Coombs, "Printed Circuits Handbook", McGraw-Hill, 2001.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC6306	WIRELESS SENSORS AND NETWORKS	3	0	0	3

Course Objective

1. To provide an outline on the characteristics and challenges of Wireless Sensor Networks
2. To discuss the network architecture of Wireless Sensor Networks
3. To understand various medium access control protocols for WSNs
4. To describe various time synchronization and topology control mechanisms for WSNs
5. To study various routing protocols and discuss the applications of WSNs

Unit	Description	Instructional Hours
I	**OVERVIEW OF WIRELESS SENSOR NETWORKS** Challenges for Wireless Sensor Networks-Characteristic Requirements, Required Mechanisms-Difference between MANETs and WSNs- Applications of WSN	9
II	**ARCHITECTURES** Single-Node Architecture - Hardware Components-Energy Consumption of Sensor Nodes - Operating Systems and Execution Environments-Example of sensor Nodes. Network Architecture -Sensor Network Scenarios- Optimization Goals and Figures of Merit. Gateway Concepts.	9
III	**MEDIUM ACCESS CONTROL PROTOCOLS** Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - SMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol. Naming and addressing: Fundamentals-Address and Name Management, Assignment of MAC Addresses.	9
IV	**TIME SYNCHRONIZATION AND TOPOLOGY CONTROL** Introduction to time synchronization problem-Protocols based on sender/receiver synchronization-localization and positioning-possible approaches-single –hop localization-positioning in multi-hop environments. Topology control-Motivation and basic ideas-controlling topology in flat network-hierarchal networks by dominating sets-hierarchal networks by clustering-combining hierarchal topologies and power control.	9
V	**ROUTING PROTOCOLS AND APPLICATIONS** Gossiping and agent-based unicast forwarding-Energy-efficient unicast-Broadcast and Multicast-Geographic routing-Mobile nodes, Application-Target detection and tracking-edge detection-Field sampling.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Discover the characteristics and challenges of Wireless Sensor Networks .
CO2: Explain the WSN network architecture and its operation.
CO3: Categorize various medium access protocols used for WSN
CO4: Discriminate the approaches for time synchronization and topology control in WSN
CO5: Evaluate the routing techniques used in WSN

TEXT BOOKS:

T1- Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
T2- Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach",Morgan Khaufmann Publishers.

REFERENCE BOOKS:

R1 - Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2007.
R2 - Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
R3 - Edgar H.Callaway,Jr. and Edgar H.Callaway,"Wirelss Sensor Networks:Architectures and Protocols", CRC Press, August 2003.

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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EC6401	CONSUMER ELECTRONICS	3	0	0	3

Course Objective

1. Knowledge of various electronic audio and video devices and systems
2. To introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices like home appliances, audio – visual and communication systems.
3. To learn fault identification and rectification
4. To learn how to select the product by the way of comparing commercially available product.
5. To learn television concepts and their standards

Unit	Description	Instructional Hours
I	**LOUDSPEAKERS AND MICROPHONES** Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones	9
II	**TELEVISION STANDARDS AND SYSTEMS** Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a Remote Control.	9
III	**OPTICAL RECORDING AND REPRODUCTION** Audio Disc – Processing of the Audio signal – read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.	9
IV	**TELECOMMUNICATION SYSTEMS** Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching. Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems	9
V	**HOME APPLIANCES** Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems; Digital watch, Calculators, An electronic guessing game, Battery charger, Decorative Lighting, LCD tunes with alarm.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe audio and video systems
CO2: Identify the problems in real time applications
CO3: Knowledge of assembling, fault diagnosis and rectification in a systematic way
CO4: Choose the best consumer product in market based on the requirement.
CO5: Differentiate various television concepts and their standards

TEXT BOOKS:

T1- S.P.Bali, "Consumer Electronics", Pearson Education, 2005.
T2- B.R. Gupta, "Consumer Electronics", S.K. Kataria & Sons, 2014.

REFERENCE BOOKS :

R1 - Ajay Sharma, "Audio video and TV Engineering-Consumer Electronics", Dhanpat Rai and co.
R2 - R.G. Gupta, "Audio and Video systems", Tata Mc Graw Hill Publishing Co.Ltd.
R3 - R. Gulati, "Monochrome and Color Television", New Age International (P) Ltd, New Delhi.

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SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7201	EMBEDDED AND REAL TIME SYSTEMS	3	0	0	3

Course Objective

1. Learn the architecture and programming of ARM processor.
2. Be familiar with the embedded computing platform design and analysis.
3. Be exposed to the basic concepts of real time Operating system.
4. Learn the system design techniques and networks for embedded systems
5. Learn various case studies based on embedded design cycle.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS** Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps –Memory system mechanisms – CPU performance- CPU power consumption.	9
II	**EMBEDDED COMPUTING PLATFORM DESIGN** The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Program validation and testing.	9
III	**PROCESSES AND OPERATING SYSTEMS** Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- Real time operating systems-POSIX-Windows CE.	9
IV	**SYSTEM DESIGN TECHNIQUES AND NETWORKS** Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.	9
V	**CASE STUDY** Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe the architecture and programming of ARM processor.
CO2: Explain the basic concepts of real time Operating system design.
CO3: Use the system design techniques to develop software for embedded systems
CO4: Differentiate general purpose operating system and the real time operating system
CO5: Model real-time applications using embedded-system concepts

TEXT BOOKS:

T1 - Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
T2 - Rajkamal, " Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education, 2011.

REFERENCE BOOKS :

R1 - Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition ,Cengage Learning, 2012.
R2 - David E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison- Wesley Professional, 2007.
R3 - Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall, 1999.
R4 - C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.
R5 - K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7202	WIRELESS COMMUNICATION	3	0	0	3

Course Objective

1. To understand the design aspects of a cellular system
2. To illustrate the behavior of the wireless channel and its impact on system design
3. To interpret the modulation and diversity techniques in wireless communications.
4. To analyze the Multiple access and reservation protocols for wireless propagation.
5. To understand the relevance of multiple antenna techniques.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction to wireless communication systems-Modern wireless communication systems: 2G ,3G and 4G cellular networks -WLAN-PAN- Cellular concept- system design fundamentals , Handoff Strategies- Interference and system capacity , Improving Coverage and Capacity .	9
II	**WIRELESS CHANNELS** Large scale path loss - Path loss models: Free Space and Two-Ray models -Link Budget design - Small scale fading- Parameters of mobile multipath channels - Doppler spread & Coherence time - flat fading - frequency selective fading - Fading due to Doppler spread - fast fading - slow fading.	9
III	**MODULATION AND DIVERSITY SCHEMES** Minimum Shift Keying, Gaussian MSK, M-ary QAM, M-ary FSK, Orthogonal Frequency Division Multiplexing, Equalization: Survey of Equalization Techniques, Linear Equalization, Non-linear Equalization, Algorithms for Adaptive Equalization, Diversity Techniques ,RAKE receiver	9
IV	**MULTIPLE ACCESS TECHNIQUES** Introduction- FDMA, TDMA, CDMA,Spread Spectrum, Multiple access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols.	9
V	**MULTIPLE ANTENNA TECHNIQUES** MIMO systems - spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design a cellular system based on resource availability and traffic demands.
CO2: Characterize a wireless channel and evolve the system design specifications.
CO3: Able to identify suitable modulation technique for the wireless channel and system under consideration.
CO4: Implement an appropriate multiple access protocol for the wireless channel.
CO5: Exploit multiple antenna techniques for capacity/ performance gains.

TEXT BOOKS:

T1 - Rappaport,T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
T2 - Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.

REFERENCE BOOKS :

R1 - Andrea Goldsmith, "Wireless Communications", Cambridge University Press, New Delhi, 2009.
R2 - Blake, Wireless Communication Technology, Thomson Delmar, 2003.
R3 - W C.Y.Lee, Mobile Communications Engineering: Theory and applications, Second Edition, McGraw- Hill International, 1998.
R4 - David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7203	MICROWAVE ENGINEERING	3	0	0	3

Course Objective

1. To enhance the knowledge in various parameters of Microwave network.
2. To develop the fundamental concepts about microwave Semiconductor devices.
3. To get familiarized with microwave semiconductor devices and its applications.
4. To understand the functional behavior of microwave tubes.
5. To study various microwave measurements

Unit	Description	Instructional Hours
I	**MICROWAVE NETWORK CHARACTERIZATION** Introduction. Microwave frequency range, significance of microwave frequency range - applications of microwaves ,Low frequency parameters-impedance ,admittance, hybrid and ABCD. High frequency parameters- s parameters,Circuit and S parameter representation of N ports , properties of S parameters-Reciprocal and lossless networks.	9
II	**MICROWAVE PASSIVE COMPONENTS** Tee junctions -Magic Tee - Rat race - Corners - bends and twists - Directional couplers - Two hole directional couplers- Ferrites - important microwave properties and applications – Termination - Gyrator- Isolator-Circulator - Attenuator - Phase changer – S Matrix for microwave components – Cylindrical cavity resonators.	9
III	**MICROWAVE SEMICONDUCTOR DEVICES** Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs -Principles of tunnel diodes - Varactor and Step recovery diodes - Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT devices. Parametric devices -Principles of operation - applications of parametric amplifier.	9
IV	**MICROWAVE TUBES** Microwave tubes- High frequency limitations - Transit time effect, Two cavity klystron amplifier- Velocity modulation -current modulation – bunching , Reflex Klystron, Slow-Wave structures-Travelling Wave Tube, Magnetron.	9
V	**MICROWAVE MEASUREMENTS** Slotted line VSWR measurement- impedance measurement- insertion loss and attenuation measurements- measurement of scattering parameters - Return loss measurement using directional coupler-Introduction to vector network analyzer and its uses- return loss and insertion loss.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Gain proficiency in characterizing multi port networks.
CO2: Compare various microwave semiconductor devices.
CO3: Analyze various waveguide components.
CO4: Analyze the performance of Microwave tubes.
CO5: Identify the measurement techniques for different parameters like VSWR, impedance ,etc

TEXT BOOKS:

T1 - Samuel Y Liao, "Microwave Devices & Circuits" , Prentice Hall of India, 2006.
T2 - Annapurna Das and Sisir K Das, "Microwave Engineering", Mc Graw Hill Inc., 2004.

REFERENCE BOOKS :

R1 - Robert. E.Collin,"Foundation of Microwave Engg" ,Mc Graw Hill.
R2 - D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7001	EMBEDDED SYSTEMS LAB	0	0	4	2

Course Objective

1. To study the architecture and interfacing in ARM processor.
2. To understand the concept of Interrupt handling in processor and FPGA.
3. To study the concept of interfacing in FPGA.

Expt. No	Description of the Experiments
1	Interfacing ADC and DAC with ARM processor
2	Interfacing of LED with ARM and FPGA.
3	Interfacing Real time clock
4	Interfacing serial port
5	Interfacing LCD and Serial port
6	Interfacing EEPROM with FPGA
7	Interrupt handling in ARM processor
8	Interrupt handling in FPGA
9	CORE generation in FPGA
10	Interfacing sensors with ARM processor
	Total Instructional Hours **45**

Course Outcome

CO1: Efficient Real time signal processing using processors by adopting the ADC / DAC process.
CO2: Fast Data transfer between memory and processor using memory interfacing concept.
CO3: Handling the real time parameters by adopting a suitable Interrupt handling technique.
CO4: Interface various components.
CO5: Generate interrupts in FPGA.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7002	OPTICAL COMMUNICATION AND MICROWAVE LAB	0	0	4	2

Course Objective

1. Understand the working principle of optical sources, detector, fibers and microwave components
2. Know about the behavior of microwave components.
3. Practice microwave measurement procedures.

Expt. No.	Description of the Experiments
	OPTICAL EXPERIMENTS
1.	DC Characteristics of LED and PIN Photo diode
2.	Coupling and bending losses of Fibers
3.	Fiber optic Analog and Digital Link
4.	Numerical Aperture determination for Fibers
5.	Attenuation Measurement in Fibers
	MICROWAVE EXPERIMENTS
6.	Characteristics of Gunn diode
7.	Characteristics of Reflex Klystron
8.	Directional Coupler Characteristics.
9.	S-parameter Measurement of the following microwave components (Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee)
10.	Radiation Pattern of Horn Antenna.
	Total Instructional Hours **45**

Course Outcome

CO1: Analyze the performance of various microwave links.
CO2: Analyze the performance of various optical links.
CO3: Test microwave components
CO4: Analyze the radiation of pattern of antenna.
CO5: Test optical components

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC7701	**TECHNICAL PRESENTATION** / IMPLANT TRAINING / CERTIFICATION COURSE / INTERNSHIP	0	0	2	1

Course Objective

1. To enable the students to gain a competitive edge in the recruitment process, groom their confidence and develop their personality
2. To groom their confidence in the society
3. To develop their personality

S.NO.	Description
1.	Presentation Skills
2.	Listening Skills
3.	Interpersonal Skills

Course Outcome

CO1: Ability to enrich the competitive knowledge of the students to develop their personality
CO2: Enabling the students to gain a competitive edge in the recruitment process
CO3: Grooming their confidence in the society

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Programme	Course code	Name of the course
B.E.	16EC7701	TECHNICAL PRESENTATION / **IMPLANT TRAINING** / CERTIFICATION COURSE / INTERNSHIP

Course Objective

1. To enrich the practical knowledge of the students
2. Opportunity to study a problem in industrial perspective
3. To provide an industrial exposure to the students as well as to develop their career in the high tech industrial requirements.

S.No.	Guidelines	Time slot
1.	Generally the students will go for their in-plant training during their semester vacations	
2	20-25 pages report to be submitted by students to the department at the end of training.	
3	PREFERABLE DOMAINS: Microcontrollers VLSI Wireless Communication Networking Electronics Information technology Embedded Robotics CNC machine Telecommunication Electronic switches and motors REPUTED COMPANIES FOR IMPLANT TRAINING ASIAN PAINTS ALSTOM BLUE STAR AIR-CONDITIONERS BPL PRICOL LMW SALZER ELECTRONICS ALL INDIA RADIO OTHER RADIO STATIONS BSNL BHEL CROMPTION GREAVES LTD DSL GODREJ HINDUSTAN MOTORS JAIN HOUSING LTD JEPPIAAR STEELS ASHOK LEYLAND APPOLO TYRES BRAKES INDIA CALIBER FINANCIAL SERVICES ELGI EQUIPMENTS GTL HYUNDAI MOTOR JEPPIAAR TECHNOLOGIES IBM INDIA PISTONS LARSEN & TOURBO NEYVELI LIGNITE CORPORATION	4 to 6 weeks

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OFFICE TIGERS
TVS MOTORS
SPIC
SANMAR
TCS
WIPRO
XANSA TECHNOLOGIES but the list may be extended.

Course Outcome

CO1: Ability to enrich the practical knowledge of the students
CO2: Able to study a problem in industrial perspective
CO3: Provide an industrial exposure to the students as well as to develop their career in the high tech industrial requirements.

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Programme	Course code	Name of the course
B.E.	16EC7701	TECHNICAL PRESENTATION / IMPLANT TRAINING / **CERTIFICATION COURSE** / INTERNSHIP

Course Objective	To create a chance to the students to think out of their box and get creative ideas of their own.

Provider	Certification courses
INTEL	Intel certification course
CISCO	CCNA - CISCO CERTIFIED NETWORK ADMINISTRATORS
MICROSOFT	MCP - MICROSOFT CERTIFIED PROFESSIONALS
MICROSOFT	MCSE - MICROSOFT CERTIFIED SOFTWARE ENGINEERS

Course Outcome	CO1: Generating a chance to the students to think out of their box and get creative ideas of their own AND show case it

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Programme	Course code	Name of the course
B.E.	16EC7701	TECHNICAL PRESENTATION /IMPLANT TRAINING/ CERTIFICATION COURSE / **INTERNSHIP**

Course Objective

1. Inculcating some industry customs in the institute
2. Facilitating opportunities for all the students to interact on a consistent basis with Industries by way of visits to many renowned companies
3. Being a part of Institution-Industry-Interface in turn reducing the curriculum gap.

Guidelines

Internships may be arranged independently from the curriculum in which students would gain work experience only.
Interns cannot displace regular employees.
Interns are not guaranteed a job at the end of the internship
If the employer and the interns understand that the interns are not entitled to wages during the internship period.
Interns must get hands-on experience with equipment and processes used in your industry.
Interns' training must primarily benefit them, not the company.
Adhere to agency policies, procedures, and rules governing professional behavior.
Be punctual, and work the required number of hours at times agreed to by the intern and their supervisor.
Notify their supervisor if they are unable to attend as planned.
Behave and dress appropriately to the particular workplace.
Respect the confidentiality of the workplace, its clients and its employees.
If things are slow, take the initiative and volunteer for different tasks or other work.
Discuss any problems with their supervisor and, if necessary, with the Internship coordinator at the department.
Criteria to consider when evaluating an internship:
Progress towards or accomplishment of learning objectives as stated in the learning agreement.
Skill development or job knowledge gained over the course of the internship.
Overall contribution to the mission of the organization.
Dependability, punctuality, attendance.
Relations with others, overall attitude.
Potential in the field.
At the end of the internship, the intern supervisor will:
Provide the student with a letter of recommendation.
Complete college/university evaluation to assess the intern's progress and skill development (if applicable)
Evaluate the overall internship experience
The evaluation form must be returned to the internship coordinator.

Course Outcome

CO1: Gain Career related experience and practical knowledge
CO2: Opportunity to explore career avenues
CO3: Valuable work experience for their resumes
CO4: Potential to earn academic credit
CO5: Increase self-confidence and Enhance conventional classroom learning methods

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PROFESSIONAL ELECTIVES

B.E.	16EC7301	EMBEDDED CONTROLLERS	3	0	0	3

Course Objective

1. To introduce the students with advanced 8 bit microcontrollers
2. To learn open source embedded controllers
3. To understand interfacing, I/O devices with embedded controllers
4. To provide an outline on the real time application development
5. To discuss various advanced Embedded Controllers

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ARDUINO** Introduction - Functional Block Diagram of Arduino – Pin Configuration - Arduino Development Board diagram (including different blocks only)	9
II	**OPEN SOURCE EMBEDDED DEVELOPMENT USING ARDUINO IDE** Arduino IDE, I/O Functions, Looping Techniques, Decision Making Techniques - Programming of an Arduino (Arduino ISP) - Arduino Boot loader - Serial Protocol (serial port Interfacing).	9
III	**INTERFACE DIGITAL AND ANALOG I/O DEVICES (Arduino Interfacing)** Initialization of Serial Port using Functions - Basic Circuit For Arduino - Interfacing LED - Switch - 7seg LED - POT, LM35, Accelerometer (ADXL3C5C) – keypad - DC motor - 16x2 LCD – coding for all interfaces.	9
IV	**ARDUINO BASED EMBEDDED SYSTEM APPLICATIONS** Motor Driver L293D, IR Sensor - Interfacing L293D with Arduino - Code for Line Follower Robot - Interfacing Accelerometer with Arduino - Record Gestures - Interfacing of Relay Driver ULN2803 with Arduino - Code for Home automation and its Control.	9
V	**ADVANCED EMBEDDED CONTROLLERS** RASPBERRY PI: Introduction - Cases and Extension Boards - Developing on the RASPBERRY PI - Programming Language – Debugging. BEAGLEBONE BLACK: Cases and Extension Boards - Developing on the BEAGLEBONE - Operating System - Programming Language.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Knowledge of advanced Embedded Controllers
CO2: Identify the open source Embedded Controllers
CO3: Discriminate various possible interfacing techniques
CO4: Develop a real time system based on Embedded Controllers
CO5: Discover the advantages of Advanced Embedded Controller Boards.

TEXT BOOKS:

T1 - Jeremy Blum, "Exploring Arduino Tools and Techniques for Engineering Wizardry", Wiley Publication, 2013.
T2 - Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", Wiley Publication, 2014.

REFERENCE BOOKS:

R1 - Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", Vijay Madisetti Publisher, 2014.
R2 - Elliot Williams, "Make: AVR Programming: Get under the hood of the AVR microcontroller family", Make Publications, 2013.
R3 - https://www.arduino.cc/en/reference/homePage

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7302	FIBRE OPTIC COMMUNICATIONS	3	0	0	3

Course Objective

1. To facilitate the knowledge about optical fiber sources and transmission techniques.
2. To understand the concepts of signal degradation in optical fibers.
3. To inculcate understanding of the fiber optical sources and coupling.
4. To explore the trends of optical fiber measurement systems.
5. To enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO OPTICAL FIBERS** Element of Optical Fiber Transmission link-- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays. Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.	9
II	**SIGNAL DEGRADATION IN OPTICAL FIBERS** Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Material Dispersion, Wave guide Dispersion, -Polarization Mode dispersion, Intermodal dispersion, Mode Coupling	9
III	**FIBER OPTICAL SOURCES AND COUPLING** Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Laser Diodes, Temperature effects. Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Fiber -to-Fiber joints, Fiber splicing.	9
IV	**FIBER OPTIC RECEIVER AND MEASUREMENTS** Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit. Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.	9
V	**OPTICAL NETWORKS AND SYSTEM TRANSMISSION** Basic Networks – SONET / SDH – Operational Principles of WDM- Broadcast and select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance- -– Solitons – Optical CDMA – Ultra High Capacity Networks.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
CO2 : Analyze the reasons for signal degradation in optical fiber.
CO3 : Identify the various optical sources and optical detectors and their use in the optical communication system.
CO4 : Measure and analyze various fiber optic fiber parameters.
CO5 : Analyze the digital transmission and its associated parameters on system performance.

TEXT BOOKS:

T1 - Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, Fourth Edition. 2010.
T2 - John M. Senior, "Optical Fiber Communication", Second Edition, Pearson Education, 2007.

REFERENCE BOOKS:

R1- Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.
R2- John Gower, "Optical Communication System", Prentice Hall of India, 2001.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7303	HIGH SPEED NETWORKS	3	0	0	3

Course Objectives

1. To impart knowledge on Frame relay networks and ATM networks
2. To understand the concepts of congestion and traffic management
3. To gain knowledge on Graph Theory and Internet Routing
4. To know more about Quality of Service in IP Networks
5. To study the importance of Compression in High Speed Networks

Unit	Description	Instructional Hours
	HIGH SPEED NETWORKS	
I	Protocols and TCP/IP Suite-TCP and IP-Frame Relay –Asynchronous Transfer Mode-High Speed LANs	9
	CONGESTION AND TRAFFIC MANAGEMENT	
II	Congestion Control in Data Networks and Internets- Link-level Flow and Error Control-TCP Traffic Control-Traffic and Congestion Controls in ATM Networks	9
	INTERNET ROUTING	
III	**Overview of Graph Theory and Least-Cost Paths-Internet Routing Protocols-Exterior Routing Protocols and Multicast**	
	QOS IN IP NETWORKS	
IV	Integrated and Differentiated Services-Protocols for QoS Support: Resource Reservation-RSVP- Multiprotocol Label Switching - Real Time Transport Protocol	9
	COMPRESSION	
V	**Overview of Information Theory: Information and Entropy, Coding-Lossless Compression- Lossy Compression**	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret ATM and Frame relay networks
CO2: Describe the concepts of congestion and traffic management
CO3: Analyze the Quality of service in IP Networks.
CO4: Infer the Principle of wireless network operation and compression
CO5: Summarize the Network management and application

TEXT BOOKS:

T1- William Stallings, "High-Speed Networks and Internets: Performance and Quality of Service", Pearson Education, Second Edition, 2002

T2- Jean Warland and Pravin Varaiya, "High Performance Communication Networksl", Jean Harcourt Asia Pvt. Ltd., Second Edition, 2001

REFERENCE BOOKS:

R1- Behrouz A. Forouzan, "Data Communication and Computer Networking", Fourth Edition, 2011

R2- Adrian Farrel, "The Internet and Its Protocols", Elsevier Publications, 2011

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7304	INTERNET AND JAVA	3	0	0	3

Course Objective

1. To Study the basic concepts and functions of internet and JAVA.
2. To interpret routing for high speed multimedia traffic
3. To learn the fundamentals in WWW, HTML and XML
4. To understand the basic concepts of java and to practice sample programs
5. To learn Java for Networking application

Unit	Description	Instructional Hours
I	**INTERNETWORKING WITH TCP / IP**: Network Technologies-Introduction, Ethernet technology,FDDI,Network predecessors , Internet addressing, Address Resolution Protocol Address Resolution Protocol, Reverse Address Resolution Protocol, Routing IP datagrams , TCP/IP over ATM networks – Basics, AAL types, Packet format , File Transfer Protocol,TFTP.	9
II	**INTERNET ROUTING:** Graph theory,Shortest path length determination-Dijkstra's algorithm,Bellman ford algorithm , Interior routing Protocols-fixed routing, adaptive routing , Distance vector protocols(RIP)-counting to infinity problem , Link state protocol(OSPF), IP Switching	9
III	**WORLD WIDE WEB:** HTTP protocol – Architectural components, URLs,HTTP GET request, error messages, length encoding,negotiation, conditional requests , Web browsers netscape, Internet explorer , HTML – tag references, image maps,tables,forms,frames , Dynamic HTML-web page layout and content positioning, dynamic styles with CSS ,Dynamic fonts, advanced Netscape DHTML,cross browser DHTML XML-Anatomy of XML documents, creating XML documents, Creating XML document type definitions.	9
IV	**INTRODUCTION TO JAVA**: Language features-Concepts of OOPS, JAVA Features, Data types, Operators and expressions, decision making, branching and looping, Arrays and strings-creating strings using string class and string buffer, Classes, Objects and methods-defining classes, creating objects, accessing class members, constructors, visibility of control, Final members and methods, Sub classing -constructors, types of inheritance.	9
V	**JAVA PROGRAMMING**: Swing: Applets and Applications, Swing features, MVC architecture, creating a swing applet and application, Understanding root, layered and content panes, closing jframe windows , Menus & Tool Bars, creating menu bar, check box, radio button, submenus, combo box , Enabling /disabling menu items, adding and removing menu items, adding buttons and other controls to menus.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Compare various networking protocols.
CO2: Design a network with available routing algorithms.
CO3: Discover the advantages of World Wide Web with the developing tools.
CO4: Knowledge of JAVA and the programming concepts.
CO5: Develop JAVA based applications.

TEXTBOOKS:

T1- Douglas E.Comer, "Internetworking with TCP/IP", Vol. I: 3rd edition, Prentice Hall of India, 1999.
T2- Eric Ladd and Jim O'Donnell, "Using HTML 4, XML and Java 1.2", Que Platinum edition, Prentice Hall of India, 1999.
T3- Robert W.Sebesta, "Programming the worldwide web", 3/e, Pearson Education, 2007.
T4- Steven Holzner et. al, "Java 2 Programming" , Black Book, Dreamtech Press, 2006.

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REFERENCE BOOKS:

R1- William Stallings, "High Speed Networks", Prentice Hall Inc., 1998.

R2- Balagurusamy. E,"Programming With Java : A Primer",TMH, 3rd Ed,2007

R3- Steven Holzner et. al, "Java 2 Programming" , Black Book, Dreamtech Press, 2006.

R4- Herbert Schildt," Java : A Beginner's Guide",TMH, 5th Ed,2005

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7305	MOBILE COMMUNICATION	3	0	0	3

Course Objective

1. Illustrate the Characteristics of various Multiplexing Techniques for Wireless communication
2. Infer the IEEE standard for the various Wireless networks.
3. Summarize the GSM and GPRS architecture and its characteristics
4. Demonstrate the network layer and transmission layer Protocols
5. Design wireless application layer protocols for Mobile communication

Unit	Description	Instructional Hours
I	**WIRELESS COMMUNICATION** Cellular systems- Frequency Management and Channel Assignment- types of handoff and their characteristics, dropped call rates & their evaluation -MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.	9
II	**WIRELESS NETWORKS** Wireless LAN – IEEE 802.11 Standards – Architecture – Services – Mobile Ad hoc Networks- WiFi and WiMAX - Wireless Local Loop	9
III	**MOBILE COMMUNICATION SYSTEMS** GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security-GSM SMS –Mobile Number portability -VoIP service for Mobile Networks – GPRS –Architecture-GPRS procedures-attach and detach procedures-PDP context procedure-combined RA/LA update procedures-Billing.	9
IV	**MOBILE NETWORK AND TRANSPORT LAYERS** Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP –Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks.	9
V	**APPLICATION LAYER** WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML –WTA	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Choose appropriate Multiplexing for Mobile computing
CO2: Analyze the IEEE standard for the various Wireless networks.
CO3: Describe the location tracking and mobility management in GSM and GPRS
CO4: Apply Mobile IP and Snooping TCP for Mobile networks.
CO5: Develop WAP model for Application layer.

TEXT BOOKS:

T1 - Jochen H. Schiller,"Mobile Communications", Second Edition, Pearson Education, 2003.
T2 - William Stallings, "Wireless Communications and Networks", Pearson Education, 2002.

REFERENCE BOOKS :

R1 - Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", First Edition, Pearson Education, 2003.
R2 - Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
R3 - C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7306	SATELLITE COMMUNICATION	3	0	0	3

Course Objective

1. To get an overview of satellite systems in relation to other terrestrial system
2. To gain knowledge of satellite orbits and launching.
3. To study of earth segment and space segment components
4. To become familiar with accessing satellites by various users.
5. To gain knowledge about advanced application based on satellite platform.

Unit	Description	Instructional Hours
I	**SATELLITE ORBITS** Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo-stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage - Launching Procedures - launch vehicles and propulsion.	9
II	**SPACECRAFT SUB SYSTEMS AND EARTH STATION** Spacecraft Subsystems -Altitude and Orbit Control - Telemetry and Tracking -Power Systems - Communication Subsystems –Transponders –Antennas -Equipment Reliability -Earth Stations.	9
III	**SPACE LINKS** The Space Link -Satellite Link Design -Satellite uplink -down link power Budget -Basic Transmission Theory -System Noise Temp -G/T Ratio -Noise Figure -Downlink Design -Design of Satellite Links for Specified C/N -Microwave Propagation on Satellite- Earth Paths. Interference between satellite circuits -Energy Dispersal -Propagation characteristics of fixed and Mobile Satellite links.	9
IV	**MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS** Single Access vs. Multiple Access (MA). Classical MA Techniques: FDMA, TDMA. Single Channel Per Carrier (SCPC) access - Code Division Multiple Access (CDMA). Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS).Mobile satellite network design, ATM via Satellite. TCP/IP via satellite -Call control –Handover and call set up procedures.	9
V	**SERVICES AND APPLICATIONS** Fixed and Mobile Services -Multimedia Satellite Services -Advanced applications based on satellite platforms - INTELSAT Series -INSAT, VSAT, Remote Sensing -Mobile Satellite Service: GSM. GPS –INMARSAT -Navigation System -Direct to Home service (DTH) -Special services -E-mail -Video Conferencing and Internet Connectivity.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To analyze the basic conceots in satellite communication
CO2: To differentiate various subsystems .
CO3: To understand the concept of uplink and downlink.
CO4: To understand multiple access techniques.
CO5: Identify different types of broadcasting/military applications

TEXT BOOKS:

T1- Dennis Roddy, Satellite Communications, McGraw Hill, 2001.
T2- Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.

REFERENCE BOOKS :

R1- N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall. 1986.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7307	ARTIFICIAL INTELLIGENCE	3	0	0	3

Course Objective

1. To learn the key aspects of Artificial Intelligence
2. To understand the features of neural network and its applications
3. To study the fuzzy logic components
4. To gain insight onto Fuzzy applications
5. To gain knowledge in genetic algorithm

Unit	Description	Instructional Hours
I	**INTRODUCTION:** Definition, history and applications of AI.Fundamentals of artificial neural network: Artificial neuron-Biological Neural networks-Applications- Typical architectures-Training- Common activation functions-Single layer net- Back Propagation neural net Radial Basis Function-Linear Vector Quantization.	9
II	**NEURAL NETS FOR PATTERN CLASSIFICATION & PATTERN ASSOCIATION:** Hebb Net-Perceptron-Adaline-Madaline- Hetro associative Memory Neural Network-Auto associative Net-Iterative Autoassociative Net-Bidirectional Associative Memory(BAM)-Architecture- Algorithm and Applications.	9
III	**FUZZY LOGIC:** Introduction to Classical sets and fuzzy sets, Classical sets,Fuzzy sets: Operations and Properties. Fuzzy Relations: Cardinality, Operations and Properties, Equivalence & tolerance. Membership function: Fuzzification, membership value assignment: Inference, rank ordering, angular fuzzy sets	9
IV	**FUZZY LOGIC APPLICATIONS** Duzzification.Fuzzy classification, Fuzzy Pattern Recognition, Fuzzy Control systems, Fuzzy image processing, Fuzzy optimization.	9
V	**GENETIC ALGORITHIM:** Introduction, basic operators& terminology, Traditional algorithm vs genetic algorithm, simple GA, general genetic algorithm, schema theorem, Classification of genetic algorithm, Holland classifier systems, genetic programming , applications of genetic algorithm	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Implement machine learning through neural networks.
CO2: Gain Knowledge to develop Genetic Algorithm and Support vector machine based machine learning system
CO3: Write Genetic Algorithm to solve the optimization problem
CO4: Understand fuzzy concepts and develop a Fuzzy expert system to derive decisions.
CO5: Able to Model Neuro Fuzzy system for data clustering and classification.

TEXT BOOKS

T3- Laurence Fausett, "Fundamentals of Neural Networks, Architecture, Algorithm and Applications" , Prentice-Hall, Inc, 2008.
T4- Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Mc.Graw Hill International Editions, Reprint 2010.
T5- S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCE BOOKS

R1- .Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall.
R2- Phillip D. Wasserman, "Neural Computing" Theory and Practice", Van Nostrand Reinhold, New York, 1989.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7308	ASIC DESIGN	3	0	0	3

Course Objective

1. To learn semi custom and full custom IC Design
2. To know the various principles of design
3. To understand the logic cells, I/O cells and interconnect architecture.
4. To design the entire FPGA design flow from the circuit and layout design point of view
5. To design the entire ASIC design flow from the circuit and layout design point of view

Unit	Description	Instructional Hours
I	**ASIC AND CMOS LOGIC DESIGN** Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.	9
II	**PROGRAMMABLE ASIC** Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA – Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.	9
III	**ASIC ARCHITECUTRE** Architecture and configuration of Spartan and Virtex FPGAs – Micro-Blaze based embedded systems – Signal probing techniques.	9
IV	**LOGIC SYNTHESIS AND TYPES OF SIMULATION** Logic Synthesis with an example-Finite State Machine Synthesis, Memory Synthesis. Simulation-Logic Systems, Cell Models, Delay Models, Static Timing Analysis, Formal verification, Switch level and Transistor level simulation.	9
V	**ASIC CONSTRUCTION** System Partitioning – FPGA Partitioning, Partitioning Methods- Kernighan-Lin algorithm.FloorPlanning, Placement-min cut & Eigenvalue algorithm, Routing-Global & Detailed routing.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Gained knowledge in the circuit design aspects at the transistor and block level abstractions of FPGA
CO2: Gained knowledge in the circuit design aspects at the transistor and block level abstractions of ASIC
CO3: Design the ASIC design flow is dealt with from the circuit and layout design point of view
CO4: Design the FPGA design flow is dealt with from the circuit and layout design point of view
CO5: Gained knowledge in FPGA and ASIC Logic synthesis - floor planning- placement and routing

TEXT BOOKS:

T1- M.J.S.Smith, " Application - Specific Integrated Circuits", Pearson, 2003.

REFERENCE BOOKS :

R1- Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science.
R2- Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, "FPGA-based Implementation of Signal Processing Systems", Wiley, 2008.
R3- Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, 1994.
R4- Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996.
R5- Jose E. France, YannisTsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7309	LOW POWER VLSI	3	0	0	3

Course Objective

1. To gain knowledge about sources of power.
2. To throw light on the power optimization techniques.
3. To learn about he design of low power CMOS circuits.
4. To identify suitable techniques to estimate the power dissipation.
5. To explore memory circuits with low power dissipation.

Unit	Description	Instructional Hours
I	**POWER DISSIPATION IN CMOS** Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design.	9
II	**POWER OPTIMIZATION** Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders and multipliers.	9
III	**DESIGN OF LOW POWER CMOS CIRCUITS** Computer arithmetic techniques for low power system – reducing power consumption in memories – low power clock, Inter connect and layout design – Advanced techniques – Special techniques.	9
IV	**POWER ESTIMATION** Power Estimation techniques – logic power estimation – Simulation power analysis – Probabilistic power analysis.	9
V	**SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER** Synthesis for low power – Behavioral level transform – software design for low power.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To differentiate the various sources of power
CO2: To analyzethe the different techniques in low power design.
CO3: To identify the power reduction techniques based on technology independent and technology dependent Power dissipation mechanism in various MOS logic style.
CO4: To analyze suitable techniques to estimate the power dissipation
CO5: To design memory circuits with low power dissipation.

TEXT BOOKS:

T1- Kaushik Roy and S.C.Prasad, "Low power CMOS VLSI circuit design", Wiley, 2000.
T2- Dimitrios Soudris, ChirstianPignet, Costas Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002.

REFERENCE BOOKS:

R1- J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999.
R2- A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995.
R3- Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.
R4- Abdelatif Belaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995.
R5- James B.Kulo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc. 2001

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7310	NETWORKS ON CHIPS	3	0	0	3

Course Objective

1. To introduce the concept of 3D NOC, architectures and protocols of 3D NOC.
2. To identify the types of fault and study the testing methods for fault rectification.
3. To identify the types of Energy and Power Issues of NOC.
4. To introduce the concept of micro-architecture NOC.
5. To learn DIMDE router for 3D NOC.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO THREE DIMENSIONAL NOC** Three-Dimensional Networks-on-Chips Architectures. – Resource Allocation for QoS On-Chip Communication – Networks-on-Chip Protocols-On-Chip Processor Traffic Modeling for Networks-on- Chip	9
II	**TEST AND FAULT TOLERANCE OF NOC** Design-Security in Networks-on-Chips-Formal Verification of Communications in Networks-on-Chips- Test and Fault Tolerance for Networks-on-Chip Infrastructures-Monitoring Services for Networks-on- Chips.	9
III	**ENERGY AND POWER ISSUES OF NOC** Energy and Power Issues in Networks-on-Chips-The CHAIN works Tool Suite: A Complete Industrial Design Flow for Networks-on-Chips.	9
IV	**MICRO-ARCHITECTURE OF NOC ROUTER** Baseline NoC Architecture – MICRO-Architecture Exploration ViChaR: A Dynamic Virtual Channel Regulator for NoC Routers- RoCo: The Row-Column Decoupled Router – A Gracefully Degrading and Energy-Efficient Modular Router Architecture for On-Chip Networks. Exploring Fault Tolerant Networks-on-Chip Architectures.	9
V	**DIMDE ROUTER FOR 3D NOC** A Novel Dimensionally-Decomposed Router for On-Chip Communication in 3D Architectures-Digest of Additional NoC MACRO-Architectural Research.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To Learn the concept of 3D NOC, architectures and protocols of 3D NOC.
CO2: To Understand the types of fault and study the testing methods for fault rectification.
CO3: To know the types of Energy and Power Issues of NOC.
CO4: To Analyze micro-architecture NOC.
CO5: To Know the concept of DimDE router for 3D NOC.

TEXT BOOKS:

T1- Chrysostomos Nicopoulos, Vijaykrishnan Narayanan, Chita R.Das ," Networks-on - Chip , Architectures- A Holistic Design Exploration", Springer.
T2- Fayezgebali, Haythamelmiligi, Hqhahed Watheq E1-Kharashi "Networks-on-Chips, theory and practice, CRC press.

REFERENCE BOOKS:

R1- Jose Duato, Sudhakar Yalamanchili, Lionel Ni, "Interconnection Networks: An Engineering Approach", Morgan Kaufmann, 2002.
R2- William James Dally, Brian Towles, "Principles and Practices of Interconnection Networks", Morgan Kaufmann, 2004.
R3- Giovanni De Micheli, Luca Benini, "Networks on Chips: Technology and Tools", Morgan Kaufmann, 2006.
R4- Natalie D. Enright Jerger, Li-Shiuan Peh, "On-Chip Networks (Synthesis Lectures on Computer Architecture)", Morgan and Claypool, 2008.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7311	OPTIMIZATION TECHNIQUES	3	0	0	3

Course Objective

1. To introduce the basic concepts of linear programming.
2. To educate on the advancements in Linear programming techniques.
3. To introduce the dynamic programming method.
4. To introduce non-linear programming techniques.
5. To introduce the interior point methods of solving problems.

Unit	Description	Instructional Hours
I	**LINEAR PROGRAMMING** Introduction – formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.	9
II	**ADVANCES IN LPP** Dualit theory- Dual simplex method – Sensitivity analysis–-Transportation problems–Assignment problems-Traveling sales man problem -Data Envelopment Analysis.	9
III	**DYNAMIC PROGRAMMING** Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion– Computational procedure–Conversion offinal value problem in to Initial value problem.	9
IV	**NON LINEAR PROGRAMMING** Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.	9
V	**INTERIOR POINT METHODS** Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Demonstrate and solve various optimization techniques.
CO2 : Learn the basic concepts of linear programming.
CO3 : Apply the dynamic programming method for current scenario problems.
CO4 : Work on non-linear programming techniques.
CO5 : Construct the interior point methods of solving problems.

TEXT BOOKS:

T1 - R.Panneerselvam, "Operations Research", PHI, 2006
T2 - Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.
T3 - Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.

REFERENCE BOOKS:

R1 - Optimization: Theory and Practice, Mohan Joshi and KannanMoudgalya, Narosa.Publishing House, Bombay.

R2 - Optimization: concepts and application engineering, Ashok Belegundu and Tirupathi Chandrupatla, Pearson Education Asia, Delhi.
R3 - Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
R4 - Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC7312	ROBOTICS	3	0	0	3

Course Objective

1. Describe the Robot anatomy and Drive systems
2. Demonstrate the End Effectors and Robot controls
3. Analyze the Robot Transformations and Sensors
4. Develop the Robot Cell Design using MATLAB and NXT
5. Outline the Micro and Nan robotics scaling and Top down and Bottom up approach.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems Hydraulic, Pneumatic and Electric system.	9
II	**END EFFECTORS AND ROBOT CONTROLS** Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Gripper force analysis-Gripper design-Robot controls-Continuous path control, Intelligent robot-Control system for robot joint-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.	9
III	**ROBOT TRANSFORMATIONS AND SENSORS** Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple transformation- Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensor	9
IV	**ROBOT CELL DESIGN AND APPLICATIONS** Robot cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.	9
V	**MICRO/NANO ROBOTICS SYSTEM** Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach-Actuators of robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Discuss the Architecture of robotic systems.
CO2 : Illustrate the Mechanical grippers and Control system of Robot.
CO3 : Differentiate the various Robot Transformations And Sensors.
CO4 : Apply Robot cell design and control-Sequence for various application.
CO5 : Construct the Micro and Nan robotics using scaling with Top down and Bottom up approach .

TEXT BOOKS:

T1 - S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
T2 - Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012

REFERENCE BOOKS:

R1 - Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, PHI Learning., 2009.
R2 - Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
R3 - P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
R4 - Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University Press, 2008

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8301	ARM SYSTEM ARCHITECHTURE AND APPLICATION	3	0	0	3

Course Objective

1. To understand need and application of ARM Microprocessors in embedded system.
2. To study the architecture of ARM series microprocessor
3. To understand architecture and features of typical ARM7& ARM CORTEX-M3 Microcontroller.
4. To learn interfacing of real world input and output devices
5. To learn embedded communication systems.

Unit	Description	Instructional Hours
I	**ARM7, ARM9, ARM11 PROCESSORS** Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, ARM7 data flow model, programmer's model, modes of Operations, Instruction set, programming in assembly language.	9
II	**ARM7 BASED MICROCONTROLLER** ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), Memory Map, GPIO, Pin Connect Block, timer, interfacing with LED, LCD, GLCD, and KEYPAD.	9
III	**ARM CORTEX PROCESSORS** Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions features and applications. Need of operating system in developing complex applications in embedded system, desired features of operating system & hardware support from processor, Firmware development using CMSIS standard for ARM Cortex. Survey of CORTEX M3 based controllers, its features and comparison.	9
IV	**ARM CORTEX M3 BASED MICROCONTROLLER** ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), System Control, Clock & Power Control, GPIO, Pin Connect Block, interfacing with RGB LED, Seven Segment, TFT Display, MOTOR control using PWM.	9
V	**APPLICATIONS** Real World Interfacing with ARM7 Based Microcontroller: Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC).Real World Interfacing with ARM-CM3 Based Microcontroller: Concept of USB, CAN, and Ethernet based communication using microcontrollers.CAN, USB, ETHERNET applications in embedded c.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Describe the ARM microprocessor architectures and its feature.
CO2 : Interface the advanced peripherals to ARM based microcontroller
CO3 : Design embedded system with available resources.
CO4 : Design of embedded arm cortex processors.
CO5 : Interpret the applications of real time world applications.

TEXT BOOKS:

T1 - Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer"s Guide – Designing and Optimizing System Software", ELSEVIER
T2 - Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER

REFERENCE BOOKS:

R1 - LPC 214x User manual (UM10139):- www.nxp.com
R2 - LPC 17xx User manual (UM10360):- www.nxp.com
R3 - ARM architecture reference manual: - www.arm.com
R4 - Trevor Martin,"An Engineer"s Introduction to the LPC2100 series", Hitex (UK) Ltd.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8302	AUTOMOTIVE ELECTRONICS	3	0	0	3

Course Objective

1. To introduce the basics of automotive electronics.
2. To understand sensors and activators.
3. To learn charging systems.
4. To provide outline of starting systems in automotives.
5. To discuss various types of batteries in automotives.

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS** Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, Security and warning system	9
II	**STARTING SYSTEM** Condition at starting, behaviour of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor. Starter switches.	9
III	**CHARGING SYSTEM** Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects. Bridge rectifiers and new developments.	9
IV	**BATTERIES AND ACCESSORIES** Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods. Horn, wiper system and trafficator.	9
V	**SENSORS AND ACTIVATORS** Types of sensors: sensor for speed,monitoring of throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids,Stepper motors and relay.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Acquire knowledge about fundamentals of Automotive Electronics
CO2 : Understand the working principle, construction of starting system
CO3 : Discriminate about the working principle, construction, characteristics of charging system
CO4 : Gain knowledge about working principle, construction, characteristics, Capacity, Efficiency and various tests on Lead Acid Battery
CO5 : Discover the concepts of various types of Sensors and Activators

TEXT BOOKS:

T1 - A.P.Young, L.Griffiths ,"Automotive Electrical Equipment", ELBS & New Press, 1999.
T2 - William.B.Riddens, "Understanding Automotive Electronics", Butter worth Heinemann Woburn

REFERENCE BOOKS:

R1 - Bechhold, "Understanding Automotive Electronics", SAE, 1998.
R2 - W.H.Crouse , "Automobile Electrical Equipment", McGraw-Hill, 1996.
R3 - A W Judge, "Modern Electrical Equipment of Automobiles", Chapman & Hall, 1992.
R4 - P.L.Kholi, "Automotive Electrical Equipment", Tata McGraw-Hill, 1995.
R5 - Robert Bosch Automotive Hand Book, SAE, 2000.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8303	E-COMMERCE TECHNOLOGY	3	0	0	3

Course Objective

1. Outline the E-commerce and industry values
2. Identify the suitable protocol
3. Compare best software tool for E – commerce
4. Describe Copy right and Intellectual property right
5. Predict best marketing strategy

Unit	Description	Instructional Hours
	INTRODUCTION TO ELECTRONICS COMMERCE	
I	Traditional commerce and E commerce –valuechains – strategic business and Industry value chains – role of E commerce.	9
	INFRASTRUCTURE	
II	TCP/IP protocol script – Internet utility programmes –HTML and XML – web client and servers – Web client/server architecture .	9
	WEB BASED TOOLS	
III	web server software feature sets – web server software and tools – web protocol – search engines – intelligent agents –EC software –web hosting – cost analysis	9
	SECURITY	
IV	Computer security classification – copy right and Intellectual property – electronic commerce threats – protecting client computers – electronic payment systems – electronic cash – strategies for marketing.	9
	INTELLIGENT AGENTS	
V	Definition and capabilities – limitation of agents – security – web based marketing – search engines and Directory registration – online advertisements – Portables and info mechanics – website design issues.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Explain value chain in E-commerce
CO2 : Analyze the suitable web client and server, through appropriate protocol
CO3 : Experiment on web servers using software tool.
CO4 : Develop the good security for digital payments.
CO5 : Use web based marketing and online advertisement to achieve the maximum

TEXT BOOKS:

T1 - Ravi Kalakota, " Electronic Commerce", Pearson Education,
T2 - Gary P Schneider "Electronic commerce", Thomson learning & James T Peny Cambridge USA, 2001.
T3 - Manlyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2002.

REFERENCE BOOKS:

R1 - Efraim Turvan J.Lee, David kug and chung, "Electronic commerce", Pearson Education Asia 2001.
R2 - Brenda Kienew, "E commerce Business", Prentice Hall, 2001.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8304	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3

Course Objective

1. To understand the concept of entrepreneurship.
2. To know the motivation factors for the entrepreneurs.
3. To analyze the business concepts and projects.
4. To impart knowledge about accounting and various taxes.
5. To understand the government policies towards partnerships.

Unit	Description	Instructional Hours
I	**ENTREPRENEURSHIP** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	9
II	**MOTIVATION** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.	9
III	**BUSINESS** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.	9
IV	**FINANCING AND ACCOUNTING** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	9
V	**SUPPORT TO ENTREPRENEURS** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Choose the entrepreneurial career.
CO2 : Defend the motivation factors for the entrepreneurship.
CO3 : Evaluate the effectiveness of a business plan and model.
CO4 : Assess the taxes and the finance of a concern.
CO5 : Relate the supports and partnerships with respect the given scenario.

TEXT BOOKS:

T1 - S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
T2 - Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th edition, Cengage Learning 2014.

REFERENCES BOOKS:

R1 - Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: paradigms and Praxis", 2nd Edition Dream Tech, 2005.
R2 - Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
R3 - Rajeev Roy, "Entrepreneurship" 2nd edition, Oxford University Press, 2011.
R4 - EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development," Institute of India, Ahmadabad, 1986.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8305	INDUSTRIAL AUTOMATION	3	0	0	3

Course Objective

1. To educate on design of signal conditioning circuits for various applications
2. To study components used in data acquisition systems and interface techniques
3. To learn the PLC Programming technique.
4. To educate on the components used in distributed control systems
5. To introduce the communication buses namely field bus

Unit	Description	Instructional Hours
I	**DESIGN OF SIGNAL CONDITIONING AND TRANSMISSION** Design of V/I Converter and I/V Converter- Analog and Digital filter design and Adaptive filter design – Signal conditioning circuit for Ph measurement, Level Measurement – Temperature measurement- Thermocouple, RTD and Thermistor - Cold Junction Compensation and Linearization –Design of RTD based Temperature Transmitter, Thermocouple based Temperature Transmitter, Capacitance based Level Transmitter and Smart Flow Transmitters-smart sensors.	9
II	**DATA ACQUISITION AND INSTRUMENT INTERFACE** Programming and simulation of Building block of instrument Automation system – Signal analysis, I/O port configuration with instrument bus protocols - ADC, DAC, DIO, counters &timers, PC hardware structure, timing, interrupts, DMA, software and hardware installation, current loop, RS 232/RS485, GPIB, USB protocols.	9
III	**PLC AND SCADA** PLC: Evolution of PLC – Sequential and Programmable controllers – Architecture – Programming of PLC – Relay logic and Ladder logic – Functional blocks – Communication Networks for PLC. PLC based control of processes – Computer control of liquid level system SCADA: - Remote terminal units, Master station, Communication architectures and Open SCADA protocols.	9
IV	**DISTRIBUTED CONTROL SYSTEM** Evolution - Different architectures - Local control unit - Operator Interface – Displays - Engineering interface- Study of any one DCS available in market - Factors to be considered in selecting DCS.	9
V	**COMMUNICATION PROTOCOLS** Introduction- Evolution of signal standard – HART communication protocol – Communication modes – HART Networks – HART commands –HART and OSI models- HART applications Field bus: - Introduction, General Field bus architecture, Basic requirements of Field bus standard, Field bus topology, Interoperability and Interchangeability	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design signal conditioning circuits for Temperature measurement.
CO2: Design suitable interface logic and data acquisition system for real time signal processing
CO3: Design a control unit employing PLC logic.
CO4: Select a suitable DCS for real time requirements.
CO5: Gain knowledge on HART networks and Protocols.

TEXT BOOKS:

T1 - Alan S Morris, "Measurement and Instrumentation Principles," Elsevier, 2006

REFERENCE BOOKS:

R1 - C.J. Chesmond, P.A.Wilson & M.R.Le Pla "Advanced Control System Technology" , viva books private limited, 1998.
R2 - Patrick h.garrett "High Performance Instrumentation And Automation" crc press, taylor & francis group, 2005.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8306	REAL TIME OPERATING SYSTEM	3	0	0	3

Course Objective

1. Describe the structure and functions of OS.
2. Outline the Process Management and Synchronization and Principles of Dead Lock.
3. Generalized the principles of Memory allocation and storage management schemes.
4. Infer the Real Time Models and Languages.
5. Demonstrate the RTOS application Domains.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO OS AND RTOS** Architecture of OS (Monolithic–Microkernel– Layered Exo–kernel and Hybrid kernel structures)–Operating system objectives and functions– Virtual Computers– Interaction of O. S. & hardware architecture– Evolution of operating systems–Batch–multiprogramming. Multitasking– Multiuser– parallel– distributed & real –time O.S.	9
II	**PROCESS MANAGEMENT OF OS/RTOS AND SYNCHRONIZATION** Uniprocessor Scheduling: scheduling algorithms: FCFS– SJF– Priority–Round Robin–UNIX Multi–level feedback queue scheduling– Thread Scheduling– Classical Problems of Synchronization: Deadlock: Principles of deadlock– Deadlock Avoidance– Deadlock Detection– An Integrated Deadlock Strategies.	9
III	**MEMORY & I/O MANAGEMENT** Memory Management requirements– Memory partitioning: Fixed– dynamic– partitioning– Buddy System Memory allocation Strategies Fragmentation– Swapping–Segmentation– Paging– Virtual Memory– Demand paging– Page Replacement Policies –Thrashing– Working Set Model	9
IV	**REAL TIME MODELS AND LANGUAGES** Event Based – Process Based and Graph based Models – Pertinent Models – Real Time Languages – RTOS Tasks — Interrupt processing – Control Blocks.	9
V	**RTOS APPLICATION DOMAINS** Comparison and study of RTOS: Vxworks and µCOS – Case studies: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Discuss the operating system structure and system functions
CO2: Indentify the critical section problem– CPU scheduling and Dead Locks.
CO3: Explain the principles of memory allocation– segmentation and paging.
CO4: Distinguish between Event based and process based models.
CO5: Apply various models for Real time Applications.

TEXT BOOKS:

T1 - C.M. Krishna– Kang– G.Shin– "Real Time Systems"– McGraw Hill– 1997

T2 - Charles Crowley– "Operating Systems–A Design Oriented approach"– McGraw Hill 1997.

REFERENCE BOOKS:

R1 - Raymond J.A.Bhur– Donald L.Bailey– "An Introduction to Real Time Systems"– PHI 1999.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8307	DISASTER MANAGEMENT	3	0	0	3

Course Objective

1. To understand basic concepts of disaster and hazards if India.
2. To study the various natural disasters.
3. To study the various manmade disasters.
4. To understand the disaster management principles.
5. To study the modern techniques used in disaster mitigation and Management

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DISASTER** Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management - India's Key Hazards –Vulnerabilities - National disaster management framework - Disaster Management Cycle.	9
II	**NATURAL DISASTER** Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions. Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.	9
III	**ANTHROPOGENIC DISASTER** Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.	9
IV	**APPROACHES IN DISASTER MANAGEMENT** Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan -Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief – Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.	9
V	**SEISMICITY** Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Capacity to integrate knowledge to manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

CO2: Capacity to analyze, and evaluate the different public health aspects of disaster events at a local and global levels, even when limited information is available.

CO3: Capacity to describe the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO4: Capacity to analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO5: Capability to manage the Public Health aspects of the disasters.

TEXT BOOK:

T1- Sharma.S.R, "Disaster management", A P H Publishers, 2011.

T2- Pardeep Sahni, Madhavi Malalgoda and Ariyabandu, "Disaster risk reduction in south asia", PHI.

REFERENCES:

R1 - VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.

R2 - Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.

R3 - Gupta.H.K, "Disaster Management", University Press, India, 2003.

R4 - Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management, IIPA, New Delhi, 2001.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8308	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	3	0	0	3

Course Objective

1. To introduce fundamental aspects of Integrated Product Development.
2. To understand the concept of selection and testing Methodologies.
3. To know the concepts of various layouts and architecture of product.
4. To study the various industrial process tool and design techniques.
5. To analyze estimation, planning and design for manufacturing and product development.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need for IPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement	9
II	**CONCEPT GENERATION, SELECTION AND TESTING** Plan and establish product specifications. Task - Structured approaches - clarification - search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability – Concept Testing Methodologies.	9
III	**PRODUCT ARCHITECTURE** Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.	9
IV	**INDUSTRIAL DESIGN** Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.	9
V	**DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT** Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.	9
	Total Instructional Hours	45

Course Outcome

CO1 : To understand the integration of customer requirements in product design.
CO2 : To apply structural approach to concept generation, selection and testing.
CO3 : To understand various aspects of design such as industrial design.
CO4 : To know the design methods for manufacture.
CO5 : To infer economic analysis and product architecture.

TEXT BOOK:

T1 - Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw –Hill International Edns.1999

REFERENCE BOOKS:

R1 - Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM Associates, 6/3, ViaOlivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.

R2 - Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.

R3 - Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8309	INTELLECTUAL PROPERTY RIGHTS AND INNOVATIONS	3	0	0	3

Course Objective

1. To introduce fundamental aspects of Intellectual property Rights
2. To understand the concept of Patents and copyrights.
3. To know the concepts of WIPO and GATT.
4. To study the Strategies and legislations of IPR.
5. To analyze Patents, Copyright, and related rights by case studies.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Invention and Creativity – Intellectual Property (IP) – Importance –Protection of IPR – Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).	9
II	**PATENTS & COPYRIGHTS** IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.	9
III	**INTRODUCTION TO WIPO & GATT** International convention relating to Intellectual Property – Establishment of WIPO –Mission and Activities – History – General Agreement on Trade and Tariff (GATT).	9
IV	**WTO AND STRATEGIES** Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy –Present against unfair competition.	9
V	**CASE STUDIES** Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : To gain knowledge on IPR.
CO2 : To know concept of Patents and copyrights.
CO3 : To understand the concepts of WIPO and GATT.
CO4 : To infer the Strategies and legislations of IPR.
CO5 : To analyze Patents, Copyright and related rights by various case studies.

TEXT BOOK:

T1 - Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan(Printers and Publishers) Pvt. Ltd., 1998.

REFERENCE BOOKS:

R1 - Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
R2 - Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8310	OPERATION RESEARCH	3	0	0	3

Course Objective

1. To understand the necessity of project Management.
2. To impart knowledge on replacement procedures
3. To impart knowledge on sequencing procedures
4. To impart knowledge on replacement procedures.
5. To impart knowledge on sequencing procedures.

Unit	Description	Instructional Hours
	PROJECT MANAGEMENT	
I	Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost .	9
	REPLACEMENT MODELS	
II	Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).	9
	SEQUENCING MODELS	
III	Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem.	9
	INVENTORY THEORY	
IV	Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.	9
	QUEUING THEORY	
V	Queuing system and its structure – Kendall"s notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Select optimal problems, solving techniques to manage projects.
CO2: Define and formulate replacement models.
CO3: Solve different problems related to Network.
CO4: Formulate and solve optimization problems related to job/ work assignments.
CO5: Choose appropriate queuing model for practical application.

TEXT BOOKS:

T1 - Taha H.A., "Operation Research", Pearson Education, Sixth Edition, 2003.
T2 - Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008.

REFERENCE BOOKS:

R1- Wagner, "Operations Research", Prentice Hall of India, 2000.
R2- Hira and Gupta "Introduction to Operations Research", S.Chand and Company.2002.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8311	TOTAL QUALITY MANAGEMENT	3	0	0	3

Course Objective

1. To learn the basic concepts of Total quality management.
2. To understand the various principles, practices of TQM to achieve quality.
3. To learn various statistical approaches for Quality control.
4. To understand the TQM tools for continuous process improvement.
5. To learn the importance of ISO Certifications.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - Need for quality - Evolution and Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - Quality control – Quality Assurance – Juran and Crosby - Barriers to TQM - Quality statements - Customer orientation, Customer retention.	9
II	**TQM QUALITY AND PRINCIPLES** Statistical Quality Control – Process Control – Control Charts – Applications – Seven tools of Quality and Management - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement.	9
III	**STATISTICAL PROCESS CONTROL** The tools of quality – Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample – Normal curve – Control charts for variables and attributes – Process capability.	9
IV	**TQM TOOLS AND TECHNIQUES** New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.	9
V	**QUALITY SYSTEMS** Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Describe the basic concepts of Total quality management.
CO2 : Interpret the various principles, practices of TQM to achieve quality.
CO3 : Infer the various statistical approaches for Quality control.
CO4 : Develop the TQM tools for continuous process improvement.
CO5 : Summarize the importance of ISO Certifications.

TEXT BOOKS

T1 - Dale H. Besterfield, Carol Besterfield-Michna, Glen Besterfield and Mary Besterfield - Sacre Total Quality Management, Third edition, Pearson Education, 2004.
T2 - Gryna Richard Chim Hai Chua, Joseph A. DeFeo, Juran's Quality Planning and Analysis for Enterprise Quality, Fifth Edition Tata McGraw-Hill, 2007.

REFERENCES

R1 - James R.Evans & William M.Lidsay, The Management and Control of Quality, Fifth Edition, South-Western (Thomson Learning), 2002.
R2 - Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991
R3 - Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
R4 - Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

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Programme	Course code	Name of the Course	L	T	P	C
B.E.	16EC8312	VLSI AND SIGNAL PROCESSING	3	0	0	3

Course Objective

1. To facilitate the knowledge about DSP Systems and applications in VLSI.
2. To understand the concepts of Retiming, Unfolding.
3. To inculcate understanding of fast convolution algorithms.
4. To learn the concept of digital lattice filter structure.
5. To enrich the knowledge about bit level arithmetic architecture.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DSP SYSTEMS** Introduction-Typical DSP algorithms- Iteration Bound – Data flow graph representations, Loop bound and iteration bound, Algorithms- Pipelining of FIR digital filters-Parallel Processing-Pipelining and parallel processing for low power	9
II	**UNFOLDING AND FOLDING** Retiming-Definitions and properties, Solving systems of inequalities, Retiming techniques-cutset retiming. Unfolding – Algorithm for Unfolding, Properties of unfolding, Critical path, Applications of unfolding, Folding Transformation.	9
III	**FAST CONVOLUTION ALGORITHMS AND ALGORITHMIC STRENGTH REDUCTION IN FILTERS** Cook-Toom algorithm-Winograd algorithm-Design of fast convolution algorithm by inspection-Parallel FIR filters-DCT and inverse DCT-Pipeline interleaving in digital filters-Pipelining in first and higher order IIR digital filters	9
IV	**DIGITAL LATTICE FILTER STRUCTURES** Schur algorithm-Digital basic lattice filters-Derivation of one multiplier, normalized and scaled normalized lattice filters- Roundoff noise calculation- Pipelining of lattice IIR digital filters with design examples- Low power CMOS lattice FIR filters	9
V	**BIT-LEVEL ARITHMETIC ARCHITECTURES** Parallel multipliers- Bit-serial multipliers-Bit serial filter design and implementation-Canonic signed digital arithmetic-Distributed arithmetic-Redundant arithmetic-Radix 2 addition, subtraction and multiplication architectures-Data format conversion	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Attain knowledge about signal DSP Systems.
CO2 : Know the properties of retiming, unfolding algorithms.
CO3 : Design fast convolution algorithms.
CO4 : Realize suitable digital lattice filter structures.
CO5 : Design bit level arithmetic architectures.

TEXTBOOKS:

T1 - Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley, Inter Science, 1999.
T2 - Gary Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, 1998.
T3 - Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", Mc Graw-Hill, 1994.

REFERENCES:

R1 - Jose E. France, Yannis Tsividis, "Design of Analog & Digital VLSI Circuits for Telecommunication and Signal Processing ", Prentice Hall, 1994.
R2 - S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.
R3 - U. Meyer – Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, Second Edition, Indian Reprint, 2007.

Chairman - BoS
ECE - HiCET

Dean (Academics)
HiCET

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)

COIMBATORE 641 032

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

2019-2020

Hindusthan College of Engineering and Technology

Approved by AICTE, New Delhi and Accredited with 'A' Grade by NAAC

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Othakalmandapam Post, Coimbatore

VISION OF THE DEPARTMENT
To evolve as a centre of excellence in Electronics and Communication Engineering, to cater the global industrial needs.

MISSION OF THE DEPARTMENT
1. To expand frontiers of knowledge through the provision of inspiring learning environment. 2. To develop the intellectual skills towards employability by fostering innovation, and creativity in learning. 3. To provide a quality system for wholesome learning to achieve progress and prosperity in life along with moral values

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Othakalmandapam Post, Coimbatore

PROGRAMME OUTCOMES

1. **ENGINEERING KNOWLEDGE** : Apply the knowledge of mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

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

4. **CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS**: Use research-based knowledge and research methods including design of experiments,analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. **MODERN TOOL USAGE** : Create ,select and apply appropriate techniques,resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **THE ENGINEER AND SOCIETY** : Apply reasoning informed by the contextual knowledge to assess societal, health, safety , legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **ENVIRONMENT AND SUSTAINABILITY**: understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of , and need for sustainable development.

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

9. **INDIVIDUAL AND TEAM WORK**: Function effectively as an individual, and as a member

or leader in diverse teams and in multidisciplinary settings.

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

11. **PROJECT MANAGEMENT AND FINANCE**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work , as a member and leader in a team, to manage projects and in multidisciplinary environment.

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

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Graduates will be able to disseminate the knowledge in Communication Engineering towards Technical Incubation.

PSO 2: Graduates will have the perseverance to learn the modern design tools for

Electronic system design and analysis.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Exhibit their technical skills and knowledge in their working environment, higher studies and research.

PEO2: Succeed in multidisciplinary dimensions by excelling through life-long learning.

PEO3: Become leaders and innovators by devising engineering solutions for social issues and problems.

R – 2016

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CO'S, PO'S & PSO'S MAPPING

SEMESTER I

16MA1101Engineering Mathematics-I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

16PH1101Engineering Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS
CO1	3	2	2	1	1	1	-	-	-	-	-	1	
CO2	3	3	1	1	2	-	-	-	-	-	-	1	
CO3	3	2	1	2	2	-	-	-	-	-	-	1	
CO4	3	2	3	2	3	1	-	-	-	-	-	1	
CO5	3	2	3	2	2	2	-	-	-	-	-	1	
Avg	3	2.2	2	1.6	2	1.3	-	-	-	-	-	1	

16CY1101Engineering Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS
CO1	3	2	2	1	1	2	-	-	-	-	-	1	
CO2	3	3	1	1	2	2	-	-	-	-	-	1	
CO3	3	2	1	2	2	2	-	-	-	-	-	1	
CO4	3	2	3	2	3	2	-	-	-	-	-	1	
CO5	3	2	3	2	2	2	-	-	-	-	-	1	
Avg	3	2.2	2	1.6	2	2	-	-	-	-	-	1	

16HE1101English for Engineers - I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

16GE1101Computer Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2

16EC1201 Electron Devices

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO 3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO 4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO 5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

16GE1001 Computer Programming Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	-	-	-	-	-	-		1	2	
CO2	3	2	2	-	-	-	-	-	-	-		1	2	
CO3	3	2	2	-	-	-	-	-	-	-		1	2	
CO4	3	2	2	-	-	-	-	-	-	-		1	2	
CO5	3	2	2	-	-	-	-	-	-	-		1	2	
Avg	3	2	2	-	-	-						1	2	-

16GE1002 Engineering Practices Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	-	-	-	-	-	-		1	2	
CO2	3	2	2	-	-	-	-	-	-	-		1	2	
CO3	3	2	2	-	-	-	-	-	-	-		1	2	
CO4	3	2	2	-	-	-	-	-	-	-		1	2	
CO5	3	2	2	-	-	-	-	-	-	-		1	2	
Avg	3	2	2	-	-	-						1	2	-

SEMESTER II

16MA2102 Engineering Mathematics-II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PS
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	
CO5	3	3	3	2	2	-	-	-	-	-	-	2	2	
Avg	3	3	3	2	2	-	-	-	-	-	-	2	2	

16PH2102Physics of Materials

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	1	1	1	1							1	1
CO2	3	3	1	1	2								2	1
CO3	3	2	1	2	2								3	2
CO4	3	3	1	2	2	1							1	1
CO5	3	2	2	3	2	1	2						2	2
Avg	3	2.4	1.2	1.8	1.8	1	2						1.8	1.4

16CY2102Environmental Sciences

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2					2	3	3	2		2	2	2	1
CO2	2	1	1			2	3	3	2		2	2	2	1
CO3	2					2	3	3	2		2	2	2	1
CO4	2	1	2			2	3	3	2		2	2	2	2
CO5	2	1	2			2	3	3	2		2	2	2	2
Avg	2					2	3	3	2		2	2	2	1

16HE2102English for Engineers - II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1									1	3			1	
CO2	2	2				2			3	3		2		1
CO3	2		2						2	3			1	
CO4		1		1					1	2		2	1	1
CO5	2	1	2		1				1	3			2	1
Avg	2	1.33	2	1	1	2			1.6	2.8		2	1.25	1

16GE2102 Engineering Graphics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2					2	3	3	2		2	2	2	1
CO2	2	1	1			2	3	3	2		2	2	2	1
CO3	2					2	3	3	2		2	2	2	1
CO4	2	1	2			2	3	3	2		2	2	2	2
CO5	2	1	2			2	3	3	2		2	2	2	2
Avg	2					2	3	3	2		2	2	2	1

16EC2201Circuit Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2					2	3	3	2		2	2	2	1
CO2	2	1	1			2	3	3	2		2	2	2	1
CO3	2					2	3	3	2		2	2	2	1
CO4	2	1	2			2	3	3	2		2	2	2	2
CO5	2	1	2			2	3	3	2		2	2	2	2
Avg	2					2	3	3	2		2	2	2	1

16PD2102Essential Life Skills

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2					2	3	3	2		2	2	2	1
CO2	2	1	1			2	3	3	2		2	2	2	1
CO3	2					2	3	3	2		2	2	2	1
CO4	2	1	2			2	3	3	2		2	2	2	2
CO5	2	1	2			2	3	3	2		2	2	2	2
Avg	2					2	3	3	2		2	2	2	1

16PS2001Physical Sciences Lab - II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	1	1	-	-	-	-	-		1	2	2
CO2	2	3	2	1	1	-	-	-	-	-		1	2	2
CO3	2	2	2	2	1	-	-	-	-	-		1	2	2
CO4	3	3	3	1	2	2	-	-	-	-	1	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	3
Avg	2.4	2.8	2.4	1.4	1.2	2	-	-	-	-	1	1.4	2	2.2

16EC2001Electric Circuits and Electron Devices Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO4	2	2	3	1	2	-	-	-	-	-	2	2	3	3
CO5	2	3	3	2	2	-	-	-	-	-	3	2	3	3
Avg	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4

SEMESTER III

16MA3106

Numerical Methods for Electronics Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	-	-	-	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2
CO3	3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2
Avg	3	3	3	3	2.6	-	-	-	-	-	-	2

16EC3201Digital Electronics

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

16EC3202 Signals and Systems

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

16EC3203 Electronic Circuits

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	3	3	3	-	3	-	3	-	-	**1**	**3**	**2**	**3**
CO2	**3**	3	3	3	-	3	-	3	-	-	**1**	**3**	**2**	**3**
CO3	**3**	3	3	3	-	3	-	3	-	-	**1**	**3**	**2**	**3**
CO4	**3**	3	3	3	-	3	-	3	-	-	**1**	**3**	**2**	**3**
CO5	**3**	3	3	3	-	3	-	3	-	-	**1**	**3**	**2**	**3**
AVG	**3**	**3**	**3**	**3**	-	**3**	-	**3**	-	-	**1**	**3**	**2**	**3**

16EC3204 Semiconductor Fabrication Technology

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

16CS3231 Data Structures and Algorithms

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS
CO1	3	2	2	-	3	-	-	-	-	-	-	1	2
CO2	3	2	2	-	3	-	-	-	-	-	-	1	2
CO3	3	2	2	-	3	-	-	-	-	-	-	1	2
CO4	3	2	2	-	3	-	-	-	-	-	-	1	2
CO5	3	2	2	-	3	-	-	-	-	-	-	1	2
AVG	3	2	2		3							1	2

16EC3001 Electronic Circuits Lab

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

16CS3031 Data Structures and Algorithms Lab

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG	3	2	2									1	2	-

SEMESTER IV

16MA4109

Probability and Random Processes

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO2	2	3	2	1	1	-	-	-	-	-	1	2	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO4	2	2	3	1	2	-	-	-	-	-	2	2	3	3
CO5	2	3	3	2	2	-	-	-	-	-	3	2	3	3
Avg	2	2.6	2.4	1.4	1.4	-	-	-	-	-	1.6	2	2.4	2.4

16EC4201Electro Magnetic Fields

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO1	PO8	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	-	-	2	-	-	-	-	3	3	1
CO2	3	3	3	3	-	-	2	-	-	-	-	3	3	1
CO3	3	2	2	3	-	-	1	-	-	-	-	3	3	1
CO4	3	3	3	2	-	-	2	-	-	-	-	3	3	1
CO5	3	2	2	2	-	-	1	-	-	-	-	3	3	1
AVG	3	2.4	2.4	2.5	-	-	1.6	-	-	-	-	3	3	1

16EC4202Control Systems

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	-	-	-	-	-	2	**2**
CO2	3	3	3	2	2	2	2	-	-	-	-	-	2	2
CO3	3	3	3	2	2	2	2	-	-	-	-	-	2	2
CO4	3	3	3	2	2	2	2	-	-	-	-	-	2	2
CO5	3	3	3	2	2	2	2	-	-	-	-	-	2	2
AVG	3	3	3	2	2	2	2						2	2

16EC4203 Measurement and Instrumentation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	3	3	3	-	-	-	2	3	3
CO2	3	3	3	3	3	2	3	3	3	-	-	2	2	3
CO3	3	2	2	2	2	2	2	3	2	-	-	-	3	3
CO4	3	3	3	2	2	2	2	3	3	-	-	3	2	3
CO5	3	3	2	3	3	3	2	3	3	-	-	3	3	3
AVG	3	3	2	2	2	2	2	3	3	-	-	3	3	3

16EC4204 Linear Integrated Circuits

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

16CS4232

Object Oriented Programming and Structures

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

16EC4001 Digital Electronics Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

16EC4002 Linear Integrated Circuits Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

SEMESTER V

16EC5201 Analog Communication

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	2	2	-	-	3	-	3	2	**3**
CO2	3	2	3	3	2	2	2	-	-	3	-	3	2	3
CO3	3	2	3	3	2	2	2	-	-	3	-	3	2	-
CO4	3	2	3	3	2	2	2	-	-	3	-	3	2	3
CO5	3	2	3	3	2	2	2	-	-	3	-	3	2	-
AV	3	3	3	3	2	2	2			2		3	3	1.8

16EC5202 Digital Signal Processing

PO&PSO ⟶	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	1			2			2	2	3
CO2	3	3	3	3	3	1			2			2	2	3
CO3	3	3	3	3	3	1			2	3		2	2	3
CO4	3	3	3	2	3	1			2	3		2	2	3
CO5	3	3	3	3	3	1			2	3		2	2	3
AVG	3	3	3	3		1			2	1.4		2	1	3

16EC5203 Data Communication and Networks

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	3	-	3	3	3	2	3	3	2
CO2	3	3	3	3	3	3	-	3	-	3	-	3	3	3
CO3	3	3	3	3	3	-	3	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	2	3	3	-	2	-	3	3
CO5	3	3	3	3	3	3	2	-	3	3	2	3	3	2
AVG	**3**	3	3	3	1.8	1.8	1.4	1.8	1.8	1.8	2	2.4	3	3

16EC5204 Microprocessors and Microcontrollers:Concepts and Applications

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	3	3	-	-	-	-	-	2	3
CO2	3	3	3	3	2	3	2	-	-	-	-	-	3	3
CO3	3	3	2	3	3	3	3	-	-	-	-	-	3	3
CO4	3	3	3	3	3	3	2	-	-	-	-	-	3	3
CO5	3	3	3	3	3	3	3	-	-	-	-	-	2	3
AVG	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3

16EC5205 Transmission Lines and Waveguides

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	**3**	3	**1**	2	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**3**	**3**
CO2	2	2	2	1	3	1	2	**-**	**-**	**2**	**-**	**-**	**3**	**2**

CO3	3	3	2	1	2	2	2	**-**	**-**	**2**	**-**	**-**	**3**	**2**
CO4	3	3	2	1	3	2	2	-	-	2	-	-	2	2
CO5	3	3	1	1	1	2	2	-	-	2	-	-	2	1
AVG	2.8	2.8	2	1	2.2	1.6	2	-	-	2	-	-	2.6	2

16EC5001 Digital Signal Processing Lab

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	2	3	3	-	-	-	-	-	2	3
CO2	3	3	3	3	2	3	2	-	-	-	-	-	3	3
CO3	3	3	2	3	3	3	3	-	-	-	-	-	3	3
CO4	3	3	3	3	3	3	2	-	-	-	-	-	3	3
CO5	3	3	3	3	3	3	3	-	-	-	-	-	2	3
AVG	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3

16EC5002 Microprocessors and Microcontrollers Lab

PO&PSO ⟶	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	2		2				3			3	3
CO2	3	2	2	2		2				3			3	3
CO3	3	2	2	2		2				3			3	3
CO4	3	2	2	2		2				3		2	3	3
CO5	3	2	2	2		2				3		2	3	3
AVG	3	2	2	2		2				3		2	3	3

SEMESTER VI

16EC6201 VLSI Design

19EC5203 / VLSI design														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	3	3	2	3	2	2	3	1	2	3	1	2	3	2
CO 2	3	3	2	3	2	2	2	1	1	2	2	2	2	2
CO 3	3	2	3	3	2	2	2	1	-	2	-	2	3	2
CO 4	3	2	3	2	2	2	2	1	2	2	1	2	2	2
CO 5	3	2	3	3	2	2	2	1	-	2	1	2	2	3
AV G	**3**	3	3	3	1.8	1.8	1.4	1	1	1.8	1	2.4	3	3

16EC6202 Digital Communication

PO&PSO ⟶	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2			2							3	3
CO2	3	2	2			2							3	3
CO3	3	2	2	2		2								3
CO4	3	2	2			2						2		3
CO5	3	2	2	3		2						2		3
AVG	3	2	2	2.5		2						1.5	1.5	3

PO&PSO ⟶	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2		2				3			3	3
CO2	3	2	2	2		2				3			3	3
CO3	3	2	2	2		2				3			3	3
CO4	3	2	2	2		2				3		2	3	3
CO5	3	2	2	2		2				3		2	3	3

16EC6204 Antenna and Wave Propagation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO2	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO3	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO4	2	3	3	3	3	2	3	2	-	-	-	2	1	2
CO5	2	2	3	3	3	2	2	2	-	-	-	2	1	2
AVG	2	2	3	3	3	2	2	2				2	1	2

16EC6001 Analog and Digital Communication Lab

PO&PSO ⟶	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			2							3	3
CO2	3	2	2			2							3	3
CO3	3	2	2	2		2								3
CO4	3	2	2			2						2		3
CO5	3	2	2	3		2						2		3
AVG	3	2	2	2.5		2						1.5	1.5	3

16EC6002 VLSI Design Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	3	1	2	3	1	2	3	2
CO2	3	3	2	3	2	2	2	1	1	2	2	2	2	2
CO3	3	2	3	3	2	2	2	1	-	2	-	2	3	2
CO4	3	2	3	2	2	2	2	1	2	2	1	2	2	2
CO5	3	2	3	3	2	2	2	1	-	2	1	2	2	3
AVG	**3**	3	3	3	1.8	1.8	1.4	1	1	1.8	1	2.4	3	3

16EC6801 Mini Project

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	2	2	3	1	2	2	1	3	1
CO2	3	2	2	3	2	2	2	3	1	2	2	1	3	1
CO3	3	2	2	3	2	2	2	3	1	2	2	1	3	1
CO4	3	2	2	3	2	2	2	3	1	2	2	1	3	1
CO5	3	2	2	3	2	2	2	3	1	2	2	1	3	1
AVG	3	2	2	3	2	2	2	3	1	2	2	2	2	1

SEMESTER VII

16EC7201 Embedded and Real Time Systems

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO 2	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO 3	2	2	3	3	3	2	2	2	-	-	-	2	1	2
CO 4	2	3	3	3	3	2	3	2	-	-	-	2	1	2
CO 5	2	2	3	3	3	2	2	2	-	-	-	2	1	2
AVG	2	2	3	3	3	2	2	2				2	1	2

16EC7202 Wireless Communication

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO 1	**3**	**3**	3	**3**	2	**2**	-	-	-	-	-	-	**3**	**2**
CO 2	3	3	3	3	2	2	-	-	-	-	-	-	3	2
CO 3	3	3	3	2	2	2	-	-	-	-	-	-	3	2
CO 4	3	3	3	3	2	3	-	1	-	-	-	-	3	2
CO 5	3	3	3	3	2	2	-	-	-	-	-	-	3	2
AVG	3	3	3	3	2	2							3	2

16EC7203Microwave Engineering

PO&PSO ⟶	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1			2			2	2	3
CO2	3	3	3	3	3	1			2			2	2	3
CO3	3	3	3	3	3	1			2	3		2	2	3
CO4	3	3	3	2	3	1			2	3		2	2	3
CO5	3	3	3	3	3	1			2	3		2	2	3
AVG	3	3	3	3		1			2	1.4		2	1	3

16EC7001 Embedded Systems Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

16EC7002 Optical Communication and Microwave Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO5	3	3	2	3	2	2	-	-	-	-	-	-	2	2
AVG	3	3	2	3	2	2						-	2	2

6EC8901 Project Work

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	2	3	2	2	2	3	3	3	3	1	3	1
CO 2	3	2	2	3	2	2	2	3	3	3	3	1	3	1
CO 3	3	2	2	3	2	2	2	3	3	3	3	1	3	1
CO 4	3	2	2	3	2	2	2	3	3	3	3	1	3	1
CO 5	3	2	2	3	2	2	2	3	3	3	3	1	3	1
AVG	3	2	2	3	2	2	2	3	3	3	3	2	2	1

Mapping of Course Outcome and Programme Outcome:

YEAR	SEM	Course Code Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	I	16MA1101 Engineering Mathematics-I	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**2**	**3**	**1**	**1**
			3	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
		16PH1101 Engineering Physics	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
		16CY1101 Engineering Chemistry	3	2.2	2	1.6	2	2	-	-	-	-	-	1	2.4	2.4
		16HE1101R Essential English for Engineers -I	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1
		16GE1101 Computer Programming	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2
		16EC1201 Electron Devices	3	2	2									1	2	-
		16PS1001 Physical Sciences Lab - I	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1
		16GE1001 Computer Programming Lab	3	2	2									1	2	-
		16GE1002 Engineering Practices Lab	**3**	**2**	**2**									**1**	**2**	
I	II	16MA2102 Engineering Mathematics-II	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**2**	**3**	**1**	**1**

		16PH2102 Physics of Materials	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
		16CY2102 Environmental Sciences	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
		16HE2102R Essential English for Engineers - II	2	1.3 333 33	2	1	1	2			1.6	2 . 8		2	1 . 2	1
		16GE2102 Engineering Graphics	2					2	3	3	2		2	2	2	1
		16EC2201Circuit Theory	2					2	3	3	2		2	2	2	1
		16PS2001 Physical Sciences Lab - II	2. 4	2.8	2. 4	1.4	1. 2	2	-	-	-	-	1	1. 4	2	2 . 2
		16EC2001 Electric Circuits and Electron Devices	2	2.6	2. 4	1.4	1. 4	-	-	-	-	-	1.6	2	2 . 4	2 . 4
II	III	16MA3106 Numerical Methods for Electronics Engineers	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**2**	**3**	**1**	**1**
		16EC3201 Digital Electronics	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
		16EC3202 Signals and Systems	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
		16EC3203 Electronic Circuits	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**3**	**-**	**-**	**1**	**3**	**2**	**3**

		16EC3204 Semiconductor Fabrication Technology	3	2	2									1	2	-
		16CS3231 Data Structures and Algorithms	3	2	2		3							1	2	1
		16EC3001 Electronic Circuits Lab	3	2	2									1	2	-
		16CS3031 Data Structures and Algorithms Lab	3	2	2									1	2	-
II		16MA4109 Probability and Random Processes	3	3	3	2	3	1	1	-	1	-	2	3	1	1
		16EC4201 Electro Magnetic Fields	3	3	2	2	1	1	1	-	1	-	2	2	1	1
		16EC4202 Control Systems	3	3	2	2	2	1	1	-	1	-	1	2	1	1
	IV	16EC4203 Measurement and Instrumentation	3	3	2	2	2	2	2	3	3	-	-	3	3	3
		16EC4204 Linear Integrated Circuits	3	3	2	3	2	2						-	2	2
		16CS4232 Object Oriented Programming and Structures	3	3	2	3	2	2						-	2	2
		16EC4001 Digital Electronics Lab	3	3	2	3	2	2						-	2	2

		16EC4002 Linear Integrated Circuits Lab	3	3	2	3	2	2						-	2	2

III	V	16EC5201 Analog Communication	3		3	3	2	3	1	1	-	1	-	2	3	1	1
		16EC5202 Digital Signal Processing	3		3	2	2	1	1	1	-	1	-	2	2	1	1
		16EC5203 Data Communication and Networks	3		3	2	2	2	1	1	-	1	-	1	2	1	1
		16EC5204 Microprocessors and Microcontrollers: Concepts and Applications	3	3	2	2	2	2	2	3	3	-	-	3	3	3	3
		16EC5205 Transmission Lines and	2.8	2.8	2	1	2.2	1.6	2	-	-	2	-	-	2.6	2	2.8
		16EC5001 Digital Signal Processing Lab	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3	**3**
		16EC5002 Microprocessors and	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3	**3**
III	VI	16EC6201 VLSI Design	**3**		**3**	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**2**	**3**	**1**	**1**
		16EC6202 Digital Communication	**3**		**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
		16EC6203 Digital Image Processing	**3**		**3**	**2**	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**
		16EC6204 Antenna and Wave Propagation	2	2	3	3	3	2	2	2				2	1	2	2
		16EC6001 Analog and Digital Communication Lab	3	2	2	2.5		2						1.5	1.5	3	3

		16EC6002 VLSI Design Lab	**3**	3	3	3	1.8	1.8	1.4	1	1	1.8	1	2.4	3	3	**3**
		16EC6801 Mini Project	3	2	2	3	2	2	2	3	1	2	2	2	2	1	3
IV		16EC7201 Embedded and Real Time	2	2	3	3	3	2	2	2				2	1	2	2
		16EC7202 Wireless Communication	3	3	3	3	2	2							3	2	3
	VII	16EC7203 Microwave Engineering	3	3	3	3		1			2	1.4		2	1	3	3
		16EC7001 Embedded Systems Lab	3	3	2	3	2	2						-	2	2	3
		16EC7002 Optical Communication and Microwave	3	3	2	3	2	2						-	2	2	3
	VIII	16EC8901 Project Work	3	2	2	3	2	2	2	3	3	3	3	2	2	1	3

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