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

2018-2019

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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ECE - HiCET

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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-2016

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

SEMESTER I

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA1101	Engineering Mathematics I (Matrices and Calculus)	3	1	0	4	25	75	100
2	16PH1101	Engineering Physics	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers -I	3	1	0	4	25	75	100
5	16GE1103	Problem solving and Python Programming	3	0	0	3	25	75	100
6	16EC1201	Electron Devices	3	0	0	3	25	75	100
PRACTICAL									
7	16PS1001	Physical Sciences Lab - I	0	0	2	1	50	50	100
8	16GE1004	Problem Solving and Python Programming Lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Laboratory	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I : Language Competency Enhancement Course-I	0	0	2	1	0	100	100
		Total Credits	**18**	**2**	**12**	**26**	**300**	**700**	**1000**

SEMESTER II

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA2102	Engineering Mathematics-II (Vector Calculus, Complex variables and Laplace transforms)	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100

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3	16CY2102	Environmental Science	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers – II	3	1	0	4	25	75	100
5	16GE2102	Engineering Graphics	2	0	4	4	25	75	100
6	16EC2201	Circuit Theory	3	1	0	4	25	75	100
PRACTICAL									
7	16PS2001	Physical Sciences Lab – II	0	0	2	1	50	50	100
8	16EC2001	Electric Circuits and Electron Devices Lab	0	0	4	2	50	50	100
9	16GE2001	Value Added Course : Language Competency Enhancement Course-II	0	0	2	1	0	100	100
		Total Credits	**17**	**3**	**12**	**26**	**250**	**650**	**900**

For the students admitted during the academic year 2017-2018 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 2016-2017 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	Microprocessor and Microcontroller: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 Lab	0	0	4	2	50	50	100
8	16EC6002	VLSI Design Lab	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

PROFESSIONAL ELECTIVE I

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
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

PROFESSIONAL ELECTIVE II

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
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

LIST OF OPEN ELECTIVES

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

CREDIT DISTRIBUTION

R2016

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

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SYLLABUS

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS I (MATRICES AND CALCULUS)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Find curvature, evolutes and envelopes using the concept of differentiation.
3. Solve ordinary differential equations of certain types using Wronskian technique.
4. Familiarize the functions of several variables which are needed in many branches of engineering.
5. Understand the concept of double and triple integrals.

Unit	Description	Instructional Hours
	MATRICES	
I	Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley - Hamilton Theorem (excluding proof) – Orthogonal matrices – Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	DIFFERENTIAL CALCULUS	
II	Curvature in cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – Involutes and Evolutes(parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.	12
	ORDINARY DIFFERENTIAL EQUATIONS	
III	Second and higher order linear differential equations with constant coefficients and with RHS of the form e^{ax} , x^n, sinax or cosax , $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is sinbx or cosbx – Method of variation of parameters – Linear differential equations with variable coefficients (Euler's equation)	12
	FUNCTIONS OF SEVERAL VARIABLES	
IV	Total differentiation (excluding implicit functions) - Partial derivatives of composite functions - Taylor's series for functions of two variables- Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers – Jacobians.	12
	MULTIPLE INTEGRALS	
V	Double integrals in Cartesian coordinates – Change of order of integration – Area enclosed by the plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.	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 (or Eigen frequencies) of vibration and the shapes of these vibrational modes

CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve

CO3: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems

CO4: Identify the maximum and minimum values of surfaces.

CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures

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TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.

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

REFERENCE BOOKS :

R1-Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.

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

R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol I, Second Edition, Pearson publishing, 2011.

R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH1101	ENGINEERING PHYSICS	3	0	0	3

Course Objective

1. Illustrate the fundamental knowledge in mechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

Unit	Description	Instructional Hours
	PROPERTIES OF MATTER AND THERMAL PHYSICS	
I	Elasticity – Hooke's law – Stress-strain diagram - Relation between three modulii of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).	9
	LASER AND APPLICATIONS	
II	Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.	9
	FIBER OPTICS AND APPLICATIONS	
III	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) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.	9
	ACOUSTICS AND ULTRASONICS	
IV	Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Ultrasonic Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.	9
	QUANTUM PHYSICS AND APPLICATIONS	
V	Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: Uunderstand the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Understand the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

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TEXT BOOKS

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2014

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY1101	ENGINEERING CHEMISTRY	3	0	0	3

Course Objective

1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
4. To acquaint the student with important concepts of spectroscopy and its applications.
5. To acquaint the students with the basics of nano materials, their properties and applications

Unit	Description	Instructional Hours
	WATER TECHNOLOGY	
I	Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.	9
	POLYMER & COMPOSITES	
II	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, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.	9
	ENERGY SOURCES AND STORAGE DEVICES	
III	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- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	9
	ANALYTICAL TECHNIQUES	
IV	Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.	9
	NANOMATERIALS	
V	Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.	9
	Total Instructional Hours	**45**

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Course Outcome

1. Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.
2. Knowledge on basic properties and application of various polymers and composites as an engineering material.
3. Summarize the various energy sources and energy storage devices
4. Analyze various analytical skills in handling various machines, instruments, apart from understanding the mechanism involved.
5. Describe the basic properties and application of nanomaterials.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).

T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

R2 - B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005).

R3 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2010).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS – I	3	1	0	4

Course Objective

- ✓ It fulfills the necessary skills needed in today's global workplaces.
- ✓ Student will be able to interpret and illustrate formal communication.
- ✓ It empowers students in choosing right lexical techniques for effective presentation
- ✓ It equips the learner to analyze and list out things in logical order
- ✓ The learner develops the ability to create and integrate ideas in a professional way.

Unit	Description	Instructional Hours
I	Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions(Adverb of Frequency) - Talking about company history and structure (Past simple, Prepositions of Time) – Talking about company activities (Connectors of addition and contrast, Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction-**General Vocabulary**.	12
II	Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple, Reasons and consequences) – Reading Test Practice Describing products Dimensions, (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words, Present continuous and going to) – Articles – Prepositions-Synonyms – Antonyms- Recommendations-**Interpretation of a chart**.	12
III	Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice-Talking about facilities(Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport(making predictions)-**Discussion on current affairs**– Tenses- Present – Past-Future-Forms of verbs- Word techniques- Formation-Prefixes-Suffixes.	12
IV	Talking about conference arrangement(checking and confirming) – Talking about a conference before, after, when, until etc. – Listening Test Practice- talking about production process – passive-Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.	12
V	Talking about call centers, insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading, Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.	12
	Total Instructional Hours	**60**

Course Outcome

CO1 - Recognize different parts of speech for better usage.
CO2 - Interpret and illustrate formal communication
CO3 - Choosing right lexical techniques for effective presentation.
CO4 - Analyze and list out things in logical order.
CO5 - Create and integrate ideas in a professional way.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
R2 - Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
R3 - Kamalesh Sadanan "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.	16GE1103	PROBLEM SOLVING AND PYTHON PROGRFAMMING (COMMON TO ALL BRANCHES)	3	0	0	3

Course Objective

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.
4. To define Python functions and call them.
5. To use Python data structures – lists, tuples, dictionaries.
6. 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 (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems:To find the greatest among three numbers, prime numbers,find minimum in a list.	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; Simple algorithms and programs: exchange the values of two variables, compute Simple interest for a given amount, Factorial of a given number.	9
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: return values, 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, sum an array of numbers, linear search.	9
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing -list comprehension; Illustrative programs: selection sort, insertion sort.	9
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.	9
	TOTAL INSTRCTIONAL HOURS	**45**

Course Outcome

Upon completion of the course, students will be able to

CO1:Develop algorithmic solutions to simple computational problems

CO2:Structure simple Python programs for solving problems.

CO3:Decompose a Python program into functions.

CO4:Represent compound data using Python lists, tuples, dictionaries.

CO5:Read and write data from/to files in Python Programs.

TEXT BOOKS:

T1 –Ashok Namdev Kamthane ,Amit Ashok Kamthane ," Programming and Problem solving with Python" McGrawHill Education

T2-Sheetal Taneja, "Python Programming A Modular Approach With Graphics,Database,Mobile and Web Applications, PEARSON .

REFERENCE BOOKS:

R1 - Reema Thareja " Python Programming Using Problem Solvimg Approach " OXFORD.

R2- E.Balagurusamy, "Problem solving and Python Programming" McGrawHill Education.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	16EC1201	ELECTRON DEVICES	3	0	0	3

Course Objective

1. To be familiar with the theory, construction, and operation of PN junction diodes.
2. To impart knowledge on the configurations, operation and models of BJT.
3. To impart knowledge on the construction, operation and models of FET.
4. To give an insight of the basic operation of special semiconductor devices.
5. To educate about various power devices and display devices.

Unit	Description	Instructional Hours
I	**SEMICONDUCTOR DIODE** Introduction to semiconductor physics- Energy band diagrams-Diffusion and drift current -Continuity equations-Theory of PN junction diode- Diode current equations- Junction Capacitance- Forward and Reverse bias characteristics- Diode Switching Characteristics- Breakdown in PN diodes- Diode Applications.	9
II	**BIPOLAR JUNCTION TRANSISTORS** Basic principle of operation of NPN and PNP configuration-Transistor current relations - Modes of operation-Types of configurations-Transistor as an amplifier - Input and Output characteristics of CE, CB and CC Configurations of BJT-Breakdown in Transistor-Transistor models- h- parameter model , Hybrid- π model .	9
III	**FIELD EFFECT TRANSISTORS** JFET - Construction and working principle – Drain and Transfer characteristics-Characteristic parameters-Drain current equation-Comparison of JFET and BJT-MOSFET: E-MOSFET,D MOSFET -Threshold voltage- Channel length modulation-Comparison of JFET and MOSFET- Equivalent circuit model of JFET and MOSFET.	9
IV	**SPECIAL SEMICONDUCTOR DEVICES** Metal - Semiconductor Junction - -Schottky Barrier Diode - Zener diode - Varactor diode –Tunnel diode -, LASER diode, LDR.	9
V	**POWER DEVICES AND DISPLAY DEVICES** UJT -PNPN Diode-Thyristors-SCR,DIAC,TRIAC,LASCR- LED, LCD, Photo diode, PhotoTransistor, Opto Coupler, Solar cell, CCD.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to explain the theory, construction, and operation of PN junction diodes.
CO2:Ability to demonstrate the theory, construction, and operation of BJT.
CO3;Ability to explain the theory, construction, and operation of FET.
CO4:Understand the basic operation of special semiconductor devices .
CO5:Understand the working of various power devices and display devices

TEXT BOOKS:

T1 - S. Salivahanan, "Electronic Devices", Second Edition, McGraw Hill Education Private Limited.
T2 - Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Prentice Hall, 10th edition, July 2008.

REFERENCE BOOKS :

R1- Jacob Millman,Christos C.Halkias,"Electronic Devices and Circuits" Tata Mc Graw Hill , 1991.
R2 - Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
R3 - Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata Mc Graw Hill, 2002.
R4 - R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.
R5 - Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LAB - I	0	0	2	1

Course Objective

1. Evaluate the particle size of micro particles and acceptance angle of fibres.
2. Employ instrumental method to determine Young's modulus of a beam of metals.
3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum

Expt. No.	Description of the Experiments
1.	Determination of Wavelength, and particle size using Laser
2.	Determination of acceptance angle and numerical aperature in an optical fiber.
3.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4.	Determination of wavelength of mercury spectrum – spectrometer grating
5.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
6.	Determination of Young's modulus by Non uniform bending method
7.	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8.	Post office box Measurement of an unknown resistance

Total Practical Hours 30

Course Outcome

CO:1 Point out the particle size of micro particles and acceptance angle of fibres using diode laser.

CO:2 Assess the Young's modulus of a beam using non uniform bending methods.

CO:3 Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum Using spectrometer.

CO:4 Identify the velocity of ultrasonic's in the given liquid.

CO:5 Illustrate phenomena of thermal conductivity of a bad conductor.

*** Student will prepare lab record during the course of the semester.

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Name of the Course

Chemistry Lab – I

Course Objective

1. Acquire practical skills in the determination of water quality parameters.
2. Acquaint the students with the determination of molecular weight of a polymer by viscometry.
3. Acquaint the students with the estimation of chemical substances using instrumental analysis techniques.

Expt. No.	Description of the Experiments
1.	Preparation of molar and normal solutions and their standardization.
2.	Estimation of total, permanent and temporary hardness of Water by EDTA
3.	Determination of chloride content of water sample by argentometric method.
4.	Determination of available chlorine in bleaching powder.
5.	Conductometric titration of strong acid vs strong base (HCl vs NaOH).
6.	Conductometric titration (Mixture of weak and strong acids)
7.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8.	Determination of molecular weight and degree of polymerization using viscometry.
9.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).

Total Practical Hours **30**

Course Outcome

CO1: Estimate the different types of hardness in a water sample.

CO2: Determine the chloride content of water sample.

CO3: Calculate the strength of acid using conductometric titrations.

CO4: Calculate the strength of strong and weak acid using conductometric titrations.

CO5: estimate the amount of salt using conductometric precipitation titrations.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1004	PROBLEM SOLVING AND PYTHON PROGRAMMING LAB (COMMON TO ALL BRANCHES)	0	0	4	2

Course Objective

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

Expt. No.	Description of the experiments
1	Compute the GCD of two numbers.
2	Find the square root of a number.
3	Exponentiation (power of a number)
4	Find the factorial of a given number
5	Print prime numbers from 1 to n numbers
6	Find the maximum of a list of numbers
7	Linear search, Binary search
8	Selection sort, Insertion sort
9	First n prime numbers
10	Multiply matrices
11	Programs that take command line arguments(word count)
12	Find the most frequent words in a text read from a file
13	Simulate bouncing ball using Pygame

Total Practical Hours 45

Course Outcome

CO1: Write, test, and debug simple Python programs.

CO2: Implement Python programs with conditionals and loops.

CO3:Develop Python programs step-wise by defining functions and calling them.

CO4:Use Python lists, tuples, dictionaries for representing compound data.

CO5:Read and write data from/to files in Python.

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1002	ENGINEERING PRACTICES LABORATORY (COMMON TO ALL BRANCHES)	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, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

S. No	Description Of The Experiments	Practical Hours
I CIVIL ENGINEERING PRACTICE		
	Study of plumbing and carpentry components of Residential and Industrial buildings.	
(A) PLUMBING WORKS:		
1	Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.	
2	Study of pipe connection requirements for pumps.	
3	Preparation of plumbing line sketches for water supply and sewage works.	
	Hands-on-exercise:	9
4	Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.	
5	Demonstration of plumbing requirements of high-rise buildings.	
(B) CARPENTRY USING POWER TOOLS ONLY:		
1	Study of the joints in roofs, doors, windows and furniture.	
2	Hands-on-exercise in wood works by sawing, planning and cutting.	
II MECHANICAL ENGINEERING		
(A) Welding:		
1	Preparation of arc welding of Butt joints, Lap joints and Tee joints	
(B) Machining:		
1	Practice on Simple step turning and taper turning	
2	Practice on Drilling Practice	
(C) Sheet Metal Work:		13
1	Practice on Models– Trays, cone and cylinder.	
DEMONSTRATION		
(D) Smithy		
➢	Smithy operations: Upsetting, swaging, setting down and bending.	
➢	Demonstration of – Production of hexagonal headed bolt.	
(E) Gas welding		
(F) Foundry Tools and operations.		

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GROUP B (ELECTRICAL & ELECTRONICS)

S.No	Description Of The Experiments	Practical Hours
ELECTRICAL ENGINEERING PRACTICES		
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	10
2	Fluorescent lamp wiring	
3	Stair case wiring.	
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.	
5	Measurement of energy using single phase energy meter.	
ELECTRONICS ENGINEERING PRACTICES		
1	Study of Electronic components and equipments – Resistors - colour coding	13
2	Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO.	
3	Study of logic gates AND, OR, NOT and NAND .	
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.	
5	Measurement of average and RMS value of Half wave and Full Wave rectifiers.	
	TOTAL INSTRUCTIONAL HOURS	**45**

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 electrical and electronics circuits.

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Programme	Course Code	Name of the Course	L	T	P	C
		ENGINEERING MATHEMATICS – II				
B.E.	16MA2102	(VECTOR CALCULUS, COMPLEX VARIABLES AND LAPLACE TRANSFORMS)	3	1	0	4
		(COMMON TO ALL BRANCHES)				

Course Objective

1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals.
2. Understand analytic functions of complex variables and conformal mappings.
3. Know the basics of residues, complex integration and contour integration.
4. Apply Laplace transform techniques to solve linear differential equations.
5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problems in mathematical physics

Unit	Description	Instructional Hours
I	**VECTOR CALCULUS** Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.	12
II	**ANALYTIC FUNCTIONS** Analytic function - Cauchy-Riemann equations - sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Construction of analytic functions (Milne-Thompson method) – Conformal mapping: $w = z+c$, cz, $1/z$ and bilinear transformation without problems related to the concept of conformal mapping.	12
III	**COMPLEX INTEGRATION** Complex integration – Statements of Cauchy's integral theorem – Taylor's and Laurent's series expansions - Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.	12
IV	**LAPLACE TRANSFORM** 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 transformation techniques.	12
V	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions-Solution of standard types of first order partial differential equations of the form $f(p,q) = 0$, Clairaut's type: $z = px + qy + f(p, q)$ – Lagrange's linear equation- Linear homogeneous partial differential equations of second and higher order with constant coefficient.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Know the gradient, divergence and curl of vectors useful for engineering application like fluid flow, electricity and magnetism.

CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically.

CO3: Evaluate real and complex integrals over suitable closed paths or contours.

CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique.

CO5: Solve the engineering problems using Partial Differential Equations.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.

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

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REFERENCE BOOKS :

R1-Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.

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

R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol II, Second Edition, Pearson publishing, 2011.

R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH2102	PHYSICS OF MATERIALS	3	0	0	3

Course Objective

1. Gain knowledge about conducting materials.
2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program.
3. Extend the properties of magnetic materials, applications and super conducting materials.
4. Defend the various types of dielectric materials and their uses.
5. Expose the students to smart materials and the basis of nano technology.

Unit	Description	Instructional Hours
I	**CONDUCTING MATERIALS** Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.	9
II	**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 – Extrinsic semiconductor - derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications	9
III	**MAGNETIC & SUPERCONDUCTING MATERIALS** **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. **Superconducting Materials :** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.	9
IV	**DIELECTRIC & COMPOSITES MATERIALS** Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization –internal field – Claussius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative) Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.	9
V	**SMART MATERIALS AND NANOTECHNOLOGY** **New Engineering Materials:** Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications. **Nano Materials**: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparicles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.	9
	Total Instructional Hours	**45**

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Course Outcome

CO1: Illustrate the electrical / thermal conductivity of conducting materials.

CO2: Understand the purpose of the acceptor or donor levels and the band gap of a semiconductor.

CO3: Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life

CO4: Identify and compare the various types of dielectric polarization and dielectric breakdown.

CO5: Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials.

TEXT BOOKS:

T1 - S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011

T2- Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

REFERENCE BOOKS:

R1 – William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.

R2 - Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.

R3 -Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY2102	ENVIRONMENTAL SCIENCE	3	0	0	3

Course Objective

1. To gain knowledge on the importance of environmental education, ecosystem and biodiversity.
2. To acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. To find and implement scientific, technological, economic and political solutions to environmental problems.
4. To study about the natural resources, exploitation and its conservation
5. To be aware of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	9
II	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution – Air pollution standards – control methods- Water pollution – Water quality parameters- Soil pollution - Marine pollution - Noise pollution- Thermal pollution - Nuclear hazards–role of an individual in prevention of pollution – pollution case studies.	9
III	**NATURAL RESOURCES** Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and Desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.	9
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- energy conversion – electrical energy calculations- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste – Global issues – Climatic change, Acid rain, greenhouse effect and Ozone layer depletion. Disaster management: floods, earthquake, cyclone and landslides.	9

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HUMAN POPULATION AND THE ENVIRONMENT

V	Population growth, variation among nations – population explosion – family welfare programme – environment and human health – 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 – Case studies.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the natural environment and its relationships with human activities.

CO2: Characterize and analyze human impacts on the environment

CO3: Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes

CO4: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

CO5: Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.

TEXT BOOKS:

T1- Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age International Publishers, New Delhi, 2014.

T2 – Deeksha Dave and S.S.Katewa, "Textbook of Environmental Studies", Second Edition, Cengage Learning, 2012.

REFERENCES:

R1 - Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.

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

R3 - Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE2102R	ESSENTIAL ENGLISH FOR ENGINEERS – II	3	1	0	4

Course Objective

- ✓ The learner will be introduced to global corporate culture and professional communication.
- ✓ It helps the students to focus on organizing professional event and documentation.
- ✓ The student will be able to describe the events and process in an effective way.
- ✓ It trains the student to analyze the problems and to find solution to it.
- ✓ The learner will be familiar with business communication.

Unit	Description	Instructional Hours
I	Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions-**Reading comprehension.**	12
II	Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice-**interpretation of posters or advertisements.**	12
III	Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms- Acronyms-Abbreviations- British and American words.	12
IV	Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)- Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – **E-mail Writing - Note completion**- Transcoding.	12
V	Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and **reply to a complaint**.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Introduced corporate culture and professional communication.

CO2: It focused on organizing a professional event and its documentation.

CO3: Improved the ability to describe the events and process in an effective way

CO4: Trained to analyze the problems and to find solution to it.

CO5: Practiced to make business communication.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.

T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

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REFERENCE BOOKS :

R1 - Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers

R2 - Technical Communication, Daniel G. Riordan, Cengage learning publishers.

R3 - Kamalesh Sadanan "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.	16GE2102	ENGINEERING GRAPHICS (COMMON TO CSE, ECE, EEE, E&I, and IT)	2	0	4	4

Course Objective
1. To provide drafting skills for communicating the Engineering concepts and ideas.
2. To expose to BIS and International standards related to engineering drawings.

UNIT	DESCRIPTION	TOTAL HOURS
I	**PLANE CURVES** Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding. Lettering and dimensioning. BIS standards and scales. Geometrical constructions. 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.	15
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).	15
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.	15
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 principal 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. Intersection of solids-cylinder vs cylinder.	15
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections of 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. Perspective projection of solids in simple position using visual ray method.	15
	TOTAL INSTRUCTIONAL HOURS	**75**

Course Outcome
At the end of the course the students will be able to:
CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.
CO2: Recognize the International Standards in Engineering Drawing practices.

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", Dhanalaksmi Publishers, Chennai.

REFERENCE BOOKS:

R1- Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited,New Delhi 2008.
R2- K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, Bangalore, 1998.
R3- M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, India, 2005.
R4-N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University press, India 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EC2201	CIRCUIT THEORY	3	1	0	4

Course Objective

1. To introduce the concept of electric circuits and its analysis.
2. To impart knowledge on solving circuits using network theorems
3. To introduce the phenomenon of resonance in coupled circuits.
4. To educate on concepts of obtaining the transient response of circuits.
5. To understand Phasor diagrams and analysis of three phase circuits

Unit	Description	Instructional Hours
I	**BASIC CIRCUITS ANALYSIS** Ohm's Law - Kirchoff's laws - DC and AC Circuits - Form Factor-Peak factor- Series and Parallel circuits –Voltage and Current division techniques– Phasor Diagram – Power and Power Factor- Mesh current and Node voltage method-Source transformation-Dependent and Independent sources .	12
II	**NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS** Star delta conversion. -Thevenin's and Norton's Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem-Compensation Theorem-Duality.	12
III	**RESONANCE AND COUPLED CIRCUITS** Series and Parallel resonance – Frequency response – Quality factor and Bandwidth - Self and Mutual inductance – Coefficient of coupling – Dot rule for coupled circuits - Tuned circuits – Single tuned and double tuned circuits.	12
IV	**CIRCUIT TRANSIENTS AND TWO PORT NETWORK** Transient response of RL, RC and RLC Circuits using Laplace transform for DC and sinusoidal inputs- Time constants - Free and forced responses-Two port networks-Z, Y, ABCD and h parameters,T and π representations .	12
V	**THREE PHASE CIRCUITS** Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connection, balanced & unbalanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits using two wattmeter method.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: To analyse AC and DC Circuits
CO2:To apply network theorems for AC and DC Circuits .
CO3:To design resonance and single tuned circuits.
CO4:To analyse two port networks.
CO5:To understand and analyse single phase and 3 phase AC circuits.

TEXT BOOKS:

T1 - Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).
T2 - William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.

REFERENCE BOOKS :

R1 - Nagoor Kani,"Electric circuits",RBA publications,First Edition.
R2 - Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
R3 - Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series,TMHl, NewDelhi, 2001.
R4 - Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
R5 - Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", II Edition, TMH (2003).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LAB - II	0	0	2	1

Course Objective

1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young's modulus by uniform bending method.

Expt. No.	Description of the Experiments
1.	Determination of Young's modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4.	Determination of Dispersive power of a prism - Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment.
8.	Calibration of ammeter using potentiometer

Total Practical Hours **30**

Course Outcome

CO: 1. Experiment involving the physical phenomena of the Rigidity modulus of wire.

CO: 2. Determine the band gap of a semiconductor and variation of Energy Gap (E_g)with temperature.

CO: 3 Assess the Young's modulus of a beam using non uniform bending method.

CO: 4. Explain the concept of interference and calculate the thickness of thin wire and other fine objects.

CO:5. Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.

*** Student will prepare lab record during the course of the semester.

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Name of the Course

Chemistry Lab – II

Course Objective

1. Acquire practical skills in the quantitative analysis of water quality parameters.
2. Acquire practical skills in the instrumental methods for quantitative estimation of metal ion content.
3. Gain knowledge in determination of rate of corrosion.

Expt. No.	Description of the Experiments
1.	Determination of Dissolved Oxygen in water by Winkler's method.
2.	Estimation of alkalinity of water sample by indicator method.
3.	Estimation of hydrochloric acid by pH metry.
4.	Estimation of ferrous iron by Potentiometry.
5.	Estimation of Copper by EDTA
6.	Determination of sodium by flame photometry
7.	Determination of corrosion rate of mild steel by weight loss method.

Total Practical Hours **30**

Course Outcome

CO1: Determine the level of DO in a water sample.

CO2: Identify and estimate the different types of alkalinity in water sample.

CO3: Estimate the acidity of water sample using pH metry.

CO4: Estimate the amount of copper in a brass sample.

CO5: Determine the metal ion content using instrumental methods.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EC2001	ELECTRIC CIRCUITS AND ELECTRON DEVICES LAB	0	0	4	2

Course Objective

1. To learn the characteristics of PN junction diode.
2. To understand the characteristics of Zener diode.
3. To learn the characteristics of Transistors.
4. To learn the basic laws and network reduction theorems
5. To learn the concept of resonance in AC circuits.

S.No	Description Of The Experiments
1	PN Junction Diode Characteristics
2	Zener Diode Characteristics
3	Common Emitter Input-Output Characteristics
4	Common Base Input-Output Characteristics
5	FET Characteristics
6	Verification Of Thevenin's and Norton's Theorem
7	Verification of KVL & KCL
8	Verification of Super Position Theorem
9	Verification of Maximum Power Transfer
10	Determination of Resonance Frequency of Series & Parallel RLC Circuits
	Total Instructional Hours 45

Course Outcome

- To understand the characteristics of PN junction diode, Zener diode and transistors.
- Apply the concept of basic laws and network reduction theorems.
- To understand the concept of resonance in AC circuits.

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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 AND 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 ALGROITHMS	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

CO1: Analyze and design different types of oscillators.
CO2: To design different types of feedback amplifiers.
CO3: To find applications for power amplifier .
CO4: Design different types of Mutlivibrators.
CO5: 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

CO1: Understand the concepts of probability and random variables.
CO2: Describe various discrete and continuous distribution functions.
CO3: 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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HICET

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

CO1:To understand the measurements concept and usage of AC/DC bridges.
CO2: To identify various types of transducers and their working.
CO3: To explain the different types of function generators and CRO.
CO4: To explore knowledge on Digital instruments.
CO5: 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 analyse 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 Astable 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 Astable and Monostable multivibrators using NE555 Timer.
6	Design Function Generator using ICL8038.
7	Simulate Integrator and Differentiator using SPICE.
8	Simulate Astable & 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	MICROPROCESSOR AND MICROCONTROLLER:CONCEPTS AND APPLICATION	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	TRANSMISSION LINES AND WAVEGUIDES	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 MICROCONTROLLERS 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 COMMUNICATION	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 PROCESSING	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 – Subband 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 PROPAGATION	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 LAB	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	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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ELECTIVE II

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- El 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.

Chairman - BoS
ECE - HiCET

Chairman

Dean (Academics)
HiCET

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.

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

2018-2019

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

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	PSO11	PSO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

16CY1101Engineering Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	1	1	2	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	2	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	2	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	2	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	2	-	-	-	-	-	1	2.4	2.4

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

16GE1101 Computer 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
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2

16EC1201 Electron Devices

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	-

16PS1001 Physical Sciences Lab – 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

16GE1001 Computer Programming 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	-

16GE1002 Engineering Practices 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 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	1.333333	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

16MA3106 Numerical Methods for Electronics Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	3	2.6	-	-	-	-	-	-	2	2	1.2

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	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	-	-	-	1	2	1
CO2	3	2	2	-	3	-	-	-	-	-	-	1	2	1
CO3	3	2	2	-	3	-	-	-	-	-	-	1	2	1
CO4	3	2	2	-	3	-	-	-	-	-	-	1	2	1
CO5	3	2	2	-	3	-	-	-	-	-	-	1	2	1
AVG	3	2	2		3							1	2	1

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 III

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 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

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

	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
AVG	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

16EC6203Digital Image Processing

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
AVG	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 ⟶	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

16EC6002 VLSI Design Lab

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO1 1	PO1 2	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

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	PO10	PO11	PO12	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	PO10	PO11	PO12	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														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	**3**	**2**	3	**3**	2	**2**	-	-	-	-	-	-	**2**	**2**
CO 2	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO 3	3	3	3	3	2	2	-	-	-	-	-	-	2	2
CO 4	3	3	2	3	2	2	-	-	-	-	-	-	2	2
CO 5	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

16EC8901 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	PO 1	PO2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2
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		16MA2102 Engineering Mathematics-II	3	3	3	2	3	1	1	-	1	-	2	3	1	1
	II	16PH2102Physics of Materials	3	3	2	2	1	1	1	-	1	-	2	2	1	1
		16CY2102Environmental Sciences	3	3	2	2	2	1	1	-	1	-	1	2	1	1

		16HE2102REssential English for Engineers - II	2	1.33	2	1	1	2			1.6	2.8		2	1.25	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		16MA3106Numerical Methods for Electronics Engineers	3	3	3	2	3	1	1	-	1	-	2	3	1	1
		16EC3201Digital Electronics	3	3	2	2	1	1	1	-	1	-	2	2	1	1
		16EC3202Signals and Systems	3	3	2	2	2	1	1	-	1	-	1	2	1	1
	III	16EC3203Electronic Circuits	3	3	3	3	-	3	-	3	-	-	1	3	2	3
		16EC3204Semiconductor Fabrication Technology	3	2	2									1	2	-
		16CS3231Data Structures and Algorithms	3	2	2		3							1	2	1

		16EC3001Electronic Circuits Lab	3	2	2									1	2	-
		16CS3031Data 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
		16EC4201Electro Magnetic Fields	3	3	2	2	1	1	1	-	1	-	2	2	1	1
		16EC4202Control Systems	3	3	2	2	2	1	1	-	1	-	1	2	1	1
		16EC4203 Measurement and Instrumentation	3	3	2	2	2	2	2	3	3	-	-	3	3	3
	IV	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
		16EC5202Digital Signal Processing	3		3	2	2	1	1	1	-	1	-	2	2	1
		16EC5203Data Communication and Networks	3		3	2	2	2	1	1	-	1	-	1	2	1
		16EC5204Microprocessors and Microcontrollers:Concepts and Applications	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3
		16EC5205Transmission Lines and Waveguides	2.8	2.8	2	1	2.2	1.6	2	-	-	2	-	-	2.6	2
		16EC5001 Digital Signal Processing Lab	**3**	3	2.6	3	2.6	3	2.6	-	-	-	-	-	2.6	3
		16EC5002 Microprocessors and Microcontrollers Lab	3	2	2	2		2				3		2	3	3
III	VI	16EC6201 VLSI Design	3		3	3	2	3	1	1	-	1	-	2	3	1
		16EC6202 Digital Communication	3		3	2	2	1	1	1	-	1	-	2	2	1
		16EC6203 Digital Image Processing	3		3	2	2	2	1	1	-	1	-	1	2	1

		16EC6204 Antenna and Wave Propagation	2	2	3	3	3	2	2	2				2	1	2
		16EC6001 Analog and Digital Communication Lab	3	2	2	2.5		2						1.5	1.5	3
		16EC6002 VLSI Design Lab	**3**	3	3	3	1.8	1.8	1.4	1	1	1.8	1	2.4	3	3
		16EC6801 Mini Project	3	2	2	3	2	2	2	3	1	2	2	2	2	1
IV		16EC7201 Embedded and Real Time Systems	2	2	3	3	3	2	2	2				2	1	2
		16EC7202 Wireless Communication	3	3	3	3	2	2							3	2
	VII	16EC7203Microwave Engineering	3	3	3	3		1			2	1.4		2	1	3
		16EC7001 Embedded Systems Lab	3	3	2	3	2	2						-	2	2
		16EC7002 Optical Communication and Microwave Lab	3	3	2	3	2	2						-	2	2
	VIII	16EC8901 Project Work	3	2	2	3	2	2	2	3	3	3	3	2	2	1

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