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. ELECTRICAL AND ELECTRONICS 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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VISION AND MISSION OF THE DEPARTMENT

VISION

To manifest itself as a valuable global resource for industry and society with strong foundation. Abetting the students with innovative ethical and creative talents of endeavoring young professionals in Electrical and Electronics Engineering.

MISSION

M1. Educate the students to acquire knowledge in recent advancement of Electrical and Electronics Engineering and prepare the students for Professional career and higher studies.

M2. Inculcate the students to develop innovation for the societal needs through research oriented teaching and creative skill enhancement training.

M3. Enunciate the students with better skills to meet the challenges of the technical world and intensify the skills towards the practical approach

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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 and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Graduates will acquire the knowledge of design, performance & testing of static & dynamic Electrical Machines, Electrical Drives, Power Electronics applicable in core and related fields.

PSO 2. Graduates will attain knowledge and acquire skills by applying modern software tools for design, simulation and analysis of Electrical Systems to successfully adapt in multi-disciplinary environments.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. Graduate will be able to execute the principles of basic science, mathematics and engineering fundamentals necessary to formulate, solve and analyze engineering problems.

PEO 2. Graduate will be able to accrete the knowledge for pursuing advanced degrees in Engineering, Science, Management, Research and Development.

PEO 3. Graduate will be able to effectuate professionalism, leadership qualities, self and continuous learning and concern for environment to meet the societal needs.

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CURRICULUM

HICET

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

TÜVRheinland CERTIFIED

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. ELECTRICAL AND ELECTRONICS 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	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	16ME1201	Basics Civil and Mechanical Engineering	3	1	0	4	25	75	100
PRACTICAL									
7	16PS1001	Physical Science 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**	**3**	**12**	**27**	**300**	**700**	**1000**

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA2102	Engineering Mathematics-II	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100
3	16CY2102	Environmental Sciences	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	16EE2201	Electrical Circuit Theory	3	0	0	3	25	75	100

PRACTICAL									
7	16PS2001	Physical Sciences Lab - II	0	0	2	1	50	50	100
8	16EE2001	Electrical Circuit Laboratory	0	0	4	2	50	50	100
9	16GE2001	Value Added Course II : Language Competency Enhancement Course-II	0	0	2	1	0	100	100
		Total Credits:	**17**	**2**	**12**	**25**	**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	16MA3103	Fourier Analysis and Statistics	3	1	0	4	25	75	100
2	16EE3201	Transformers and DC Machines	3	0	0	3	25	75	100
3	16EE3202	Electronic Devices and Circuits	3	0	0	3	25	75	100
4	16EE3203	Measurements and Instrumentation	3	0	0	3	25	75	100
5	16EE3204	Electromagnetic Theory	3	0	0	3	25	75	100
6	16EE3205	Power Plant Engineering	3	0	0	3	25	75	100
PRACTICAL									
7	16EE3001	Transformers and DC Machines Laboratory	0	0	4	2	50	50	100
8	16EE3002	Electronic Devices and Circuits Laboratory	0	0	4	2	50	50	100
		Total Credits:	**18**	**1**	**8**	**23**	**250**	**550**	**800**

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA4107	Numerical Methods	3	1	0	4	25	75	100
2	16EE4201	Induction and Synchronous Machines	3	1	0	4	25	75	100
3	16EE4202	Linear Integrated Circuits and Applications	3	0	0	3	25	75	100
4	16EE4203	Digital Logic Circuits	3	0	0	3	25	75	100
5	16EE4204	Transmission and Distribution	3	0	0	3	25	75	100
6	16EE4205	Renewable Energy Sources	3	0	0	3	25	75	100
PRACTICAL									
7	16EE4001	Induction and Synchronous Machines Laboratory	0	0	4	2	50	50	100
8	16EE4002	Linear and Digital Integrated Circuits Laboratory	0	0	4	2	50	50	100
		Total Credits:	**18**	**2**	**8**	**24**	**250**	**550**	**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	16EE5201	Design of Electrical Machines	3	0	0	3	25	75	100
2	16EE5202	Discrete Time Systems and Signal Processing	3	0	0	3	25	75	100
3	16EE5203	Microprocessors and Microcontrollers	3	0	0	3	25	75	100
4	16EE5204	Control Systems	3	1	0	4	25	75	100
5	16IT5231	Object Oriented Programming using Java	3	0	0	3	25	75	100
6	***16EE53XX***	***Professional Elective – I***	3	0	0	3	25	75	100
PRACTICAL									
7	16EE5001	Microprocessors and Microcontrollers Laboratory	0	0	4	2	50	50	100
8	16EE5002	Control and Instrumentation Laboratory	0	0	4	2	50	50	100
9	16IT5031	Object Oriented Programming Laboratory	0	0	4	2	50	50	100
		Total Credits:	**18**	**1**	**12**	**25**	**300**	**600**	**900**

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EE6201	Power System Analysis	3	1	0	4	25	75	100
2	16EE6202	Power Electronics	3	0	0	3	25	75	100
3	16EE6203	Protection and Switchgear	3	0	0	3	25	75	100
4	16EE6204	Embedded Systems	3	0	0	3	25	75	100
5	***16EE63XX***	***Professional Elective -II***	3	0	0	3	25	75	100
6	***16XX64XX***	***Open Elective - I***	3	0	0	3	25	75	100
PRACTICAL									
7	16EE6001	Power System Simulation Laboratory	0	0	4	2	50	50	100
8	16EE6002	Power Electronics Laboratory	0	0	4	2	50	50	100
9	16EE6003	Circuits Design Laboratory	0	0	4	2	50	50	100
		Total Credits:	**18**	**1**	**12**	**25**	**300**	**600**	**900**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE - I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EE5301	Power System Transients	3	0	0	3	25	75	100
2	16EE5302	Fibre Optics and Laser Instruments	3	0	0	3	25	75	100
3	16EE5303	High Voltage Engineering	3	0	0	3	25	75	100
4	16EE5304	Principles of Management	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE - II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EE6301	Power Quality	3	0	0	3	25	75	100
2	16EE6302	Flexible AC Transmission Systems	3	0	0	3	25	75	100
3	16EE6303	Software for Circuit Simulation	3	0	0	3	25	75	100
4	16EE6304	Principles of Robotics	3	0	0	3	25	75	100

OPEN ELECTIVE - OE

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16EE6401	Industrial Automation - PLC and SCADA	3	0	0	3	25	75	100

CREDIT R2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	24	25	25	22	16	187

Chairman, Board of Studies **Dean – Academics** **Principal**

Dr.MAGUDESWARAN P.N
Dean-Academics
Hindusthan College of
Engineering and Technology,
COIMBATORE-641 032.

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS – I (COMMON TO ALL BRANCHES)	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
I	**MATRICES** 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
II	**DIFFERENTIAL CALCULUS** 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
III	**ORDINARY DIFFERENTIAL EQUATIONS** 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
IV	**FUNCTIONS OF SEVERAL VARIABLES** 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
V	**MULTIPLE INTEGRALS** 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

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 (COMMON TO ALL BRANCHES)	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
I	**PROPERTIES OF MATTER AND THERMAL PHYSICS** 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
II	**LASER AND APPLICATIONS** 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
III	**FIB.E.R OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – 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
IV	**ACOUSTICS AND ULTRASONICS** Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.	9
V	**QUANTUM PHYSICS AND APPLICATIONS** 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.

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., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY1101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	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**

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 nano materials.

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 (COMMON TO ALL BRANCHES)	3	1	0	4

Course Objective

1. It fulfills the necessary skills needed in today's global workplaces.
2. Student will be able to interpret and illustrate formal communication.
3. It empowers students in choosing right lexical techniques for effective presentation
4. It equips the learner to analyze and list out things in logical order
5. 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 PROGRAMMING (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, Towers of Hanoi.	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, compute Simple interest for a given amount, Factorial of a given number ,distance between two points.	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, exponentiation, sum an array of numbers, linear search,binary 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,histogram.	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; Illustrative programs: word count,copy file.	9
	Total Instructional 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.

TEXTBOOKS:

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 .

REFERENCES:

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.	16ME1201	BASICS OF CIVIL AND MECHANICAL ENGINEERING	3	1	0	4

Course Objective

1. To impart basic knowledge on Civil and Mechanical Engineering.
2. To explain the materials used for the construction of civilized structures.
3. To make the understand the fundamentals of construction of structure.
4. To explain the component of power plant units and detailed explanation to IC engines their working principles.
5. To explain the R & AC system.

Unit	Description	Instructional Hours
I	**SURVEYING AND CIVIL ENGINEERING MATERIALS** **Surveying**: Objects – types – classification – principles – measurements of distances **Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections-Woods-Plastics.	12
II	**BUILDING COMPONENTS AND STRUCTURES** **Foundations:** Types, Bearing capacity – Requirement of good foundations. **Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Types of Bridges and Dams.	12
III	**POWER PLANT ENGINEERING** Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.	12
IV	**IC ENGINES** Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.	12
V	**REFRIGERATION AND AIR CONDITIONING SYSTEM** Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.	12
	Total Instructional Hours	**60**

Course Outcome

CO1-Ability to explain the usage of construction material and proper selection of construction materials.
CO2-Ability to design building structures.
CO3-Ability to identify the components use in power plant cycle.
CO4-Ability to demonstrate working principles of petrol and diesel engine.
CO5-Ability to explain the components of refrigeration and Air conditioning cycle.

TEXT BOOKS:

T1 Venugopal K. and Prahu Raja V., Basic Mechanical Engineeringl, Anuradha Publishers, Kumbakonam, 2000.

T2 Shanmugam G and Palanichamy M S, Basic Civil and Mechanical Engineeringl, Tata McGraw Hill Publishing Co., New Delhi, 1996.

REFERENCE BOOKS:

R1 Ramamrutham S., Basic Civil Engineering, Dhanpat Rai Publishing Co. (P) Ltd. 1999.

R2 Seetharaman S., Basic Civil Engineering, Anuradha Agencies, 2005.

R3 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LABORATORY – IPHYSICS LAB I (COMMON TO ALL BRANCHES)	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.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LABORATORY – I CHEMISTRY LAB – I (COMMON TO ALL BRANCHES)	0	0	2	1

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 PROGRAMMINGLABORATORY (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 and dictionaries.
5. Read and write data from/to files in Python.

Expt. No.	Description of the Experiments	
1.	Compute the GCD of two numbers.	3
2.	Find the square root of a number (Newton's method)	3
3.	Exponentiation (power of a number)16	3
4.	Find the factorial of a given number	3
5.	Print prime numbers from 1 to n numbers	3
6.	Find the maximum of a list of numbers	3
7.	Linear search and Binary search	3
8.	Selection sort, Insertion sort	3
9.	Merge sort	3
10.	First n prime numbers	3
11.	Multiply matrices	3
12.	Programs that take command line arguments(word count)	3
13.	Find the most frequent words in a text read from a file	3
14.	Simulate elliptical orbits in Pygame	3
15.	Simulate bouncing ball using Pygame	3
	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: 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)

Expt. No. — **Description of the Experiments**

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.
4. Hands-on-exercise:
   - 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:

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.

GROUP B (ELECTRICAL & ELECTRONICS)

S.No	Description of the Experiments
	ELECTRICAL ENGINEERING PRACTICES
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of energy using single phase energy meter.
	ELECTRONICS ENGINEERING PRACTICES
1	Study of Electronic components and equipments – Resistors - colour coding
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 Practical Hours **45**

Course Outcome

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
B.E.	16GE1003	VALUE ADDED COURSE I: LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ To enhance student language competency
- ✓ To identify individual students level of communication skills
- ✓ To develop English Vocabulary and spoken communication skills.
- ✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	**Listening** Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	**Reading** English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	**Speaking** Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	**Writing** Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	**Art of Communication** Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
	Total Instructional Hours	**15**

Course Outcome

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

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
4 Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA2102	ENGINEERING MATHEMATICS – II (COMMON TO ALL BRANCHES)	3	1	0	4

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, "Engineering Mathematics", McGraw Hill education (India) Private Ltd., Chennai, 2017.

T2 Veerarajan T, "Engineering Mathematics–II", 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 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 (COMMON TO ALL BRANCHES)	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 – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors –direct and indirect band gap of semiconductors- 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

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 SCIENCES (B.E /B.TECH AERO,AUTO,CSE,ECE,EEE,E&I,IT,MECH,MECT)	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: Worldfood problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energyneeds, 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
V	**HUMAN POPULATION AND THE ENVIRONMENT** 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 (COMMON TO ALL BRANCHES)	3	1	0	4

Course Objective

1. The learner will be introduced to global corporate culture and professional communication.
2. It helps the students to focus on organizing professional event and documentation.
3. The student will be able to describe the events and process in an effective way.
4. It trains the student to analyze the problems and to find solution to it.
5. The learners 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.

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 ALL BRANCHES)	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
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.	16EE2201	ELECTRICAL CIRCUIT THEORY (COMMON TO EEE & EIE BRANCHES)	3	0	0	3

Course Objective

1. Analyze electric circuits and solve complex circuits
2. Impart knowledge on various network theorems in AC and DC circuits
3. Provide knowledge on resonance phenomenon and analyze coupled circuits
4. Analyze transient response of AC and DC inputs to RL.RC and RLC circuits
5. Draw phasor diagrams of voltage and current for three phase circuits and measure power and power factor.

Unit	Description	Instructional Hours
I	**BASIC CIRCUITS ANALYSIS** Ohm's Law – Kirchoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and Node voltage method –Super Mesh-Super Node – Phasor Diagram – Power, Power Factor and Energy.	9
II	**NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS** Network reduction: voltage and current division, source transformation – Dependent sources and Independent sources - star delta conversion. Thevenin's and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem-Millman's Theorem.	9
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 circuits.	9
IV	**TRANSIENT RESPONSE** Transient response of RL, RC and RLC Circuits using Laplace transform for DC input - Time constants - Transient response of A.C. circuits for single loop circuit.	9
V	**THREE PHASE CIRCUITS** Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected, balanced & unbalanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits using two wattmeter method.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply basic laws to electrical circuits.
CO2: Solve electrical circuits using network theorems
CO3: Explain the concept of resonance and solve coupled circuit problems
CO4: Carryout problems in DC and AC transients
CO5: Analyse and calculate three phase AC circuit parameters

TEXT BOOKS:

T1 William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.

T2 Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.

REFERENCE BOOKS:

R1 Paranjothi SR, "Electric Circuits Analysis", New Age International Ltd., New Delhi, 1996.

R2 Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series,Tata McGraw-Hill, NewDelhi, 2001.

R3 Chakrabati A, "Circuits Theory (Analysis and synthesis)", Dhanpath Rai & Sons, New Delhi, 1999.

R4 Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LABORATORY – II PHYSICS LAB II (COMMON TO ALL BRANCHES)	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

CO1: Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO2: Determine the band gap of a semiconductor and variation of Energy Gap (E_g)with temperature.
CO3: Assess the Young's modulus of a beam using non uniform bending method.
CO4: Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO5: Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LAB II CHEMISTRY LAB – II (COMMON TO ALL BRANCHES)	0	0	2	1

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	P	T	C
B.E.	16EE2001	ELECTRICAL CIRCUIT LABORATORY (COMMON TO EEE & EIE BRANCHES)	0	0	4	2

Course Objective

1. To provide practical experience on verification of kirchoff's voltage law, kirchoff's current law and network theorems.
2. To design series and parallel resonant circuit and to analyse the simulation results.
3. To compare the time constant values of RL,RC circuits by conducting suitable experiments
4. To measure three phase power using two wattmeter method .
5. To provide knowledge on signal measurements using CRO and DSO .

S.No	Description of the experiments	Total Practical Hours
1.	Experimental verification of Kirchhoff's voltage and current laws	
2.	Experimental verification of network theorems (Thevenin's and Superposition).	
3.	Experimental verification of network theorems (Reciprocity Theorem and Maximum power transfer Theorem).	
4.	Experimental determination of time constant of RL & RC electric circuits.	
5.	Experimental determination of frequency response of RLC circuits.	
6.	Design and Simulation of series resonance circuit.	
7.	Design and Simulation of parallel resonant circuits.	
8.	Simulation of three phases balanced and unbalanced star, delta networks circuits.	
9.	Experimental determination of power in three phase circuits by two-watt meter method.	
10.	Study of CRO, DSO and measurement of sinusoidal voltage, frequency and power factor	
	Total Instructional Hours	45

Course Outcome

CO1: Verify ohm's law and Kirchoff's law
CO2: Understand and verify theorems
CO3: Perform mesh and nodal analysis
CO4:Understand transient response of RL,RC circuits for DC input
CO5: Evaluate frequency response of series, parallel resonant circuits and tuned circuits

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE2001	VALUE ADDED COURSE – II: LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ **To improve communication skills and Professional Grooming.**
- ✓ **To impart deeper knowledge of English Language and its practical application in different facets of life.**
- ✓ **To equip the techniques of GD, Public Speaking, debate etc.**

Unit	Description	Instructional Hours
I	**Listening** Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
II	**Reading** Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
III	**Speaking** Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
IV	**Writing** Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
V	**Language Development** Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
	Total Instructional Hours	**15**

Course Outcome

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

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3103	FOURIER ANALYSIS AND STATISTICS (COMMON TO AERO, AUTO, MECH, EEE AND EIE)	3	1	0	4

Course Objectives

1. Introduce Fourier series analysis which is central to many applications in engineering.
2. Solve boundary value problems by applying Fourier series.
3. Acquaint with Fourier transform techniques used in wide variety of situations.
4. Provide the necessary basic concepts of some statistical methods.
5. Manipulate different kinds of problems occurring in engineering and technology by applying the design of experiments.

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis. A spring -mass system deriven by an alterating square force, A series circuit with a sqaure –wave voltage, power delievered by a periodic current and modelling radiation intensity.	12
II	**BOUNDARY VALUE PROBLEMS** Classification - solution of one dimensional wave equation — one dimensional heat equation — steady state solutions of two dimensional heat equations (excluding insulated edges) – Fourier series solution in cartesian coordinates.	12
III	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem – Parseval's identity.	12
IV	**TESTING OF HYPOTHESIS** Large sample test based on Normal distribution for single mean and difference of means – Tests based on t (for single mean and difference of means) - F distribution – for testing difference of variance, Chi – Square test for Contingency table (Test for Independency) – Goodness of fit.	12
V	**DESIGN OF EXPERIMENTS** One way and two way classifications - Completely randomized design – Randomized block design –Latin square design.	12
	Total Instructional Hours	60 Hrs

Course Outcomes

CO1: Understand the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering.
CO2: Acquire the knowledge of application of Fourier series in solving the heat and wave equations.
CO3: Obtain the knowledge of Fourier transform techniques which extend its applications in Electrical circuit analysis, control system design and signal processing.
CO4: Acquire skills in analyzing statistical methods.
CO5: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

T1 - Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
T2 - Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 2011.

REFERENCE BOOKS :

R1 - C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, Mc Graw Hill Education India Private Limited, New Delhi 2003.
R2 - Kandasamy P., Thilagavathy K. and Gunavathy K.,"Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996.
R3 - Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3201	TRANSFORMERS AND DC MACHINES	3	0	0	3

Course Objective

1. Recall the usage of magnetic materials in magnetic-circuits and their properties.
2. Familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers.
3. Explains the working principles of electrical machines using the concepts of electromechanical energy conversion principles
4. Practice the working principles of DC machines as Generator types, and their no-load / load characteristics.
5. Estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance, starting methods and speed control of DC motors

Unit	Description	Instructional Hours
I	**MAGNETIC CIRCUITS AND MAGNETIC MATERIALS** Magnetic circuits - Flux linkage, Inductance and energy - Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysterisis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.	9
II	**TRANSFORMERS** Construction and Working - Parts of a Transformer - Emf equation - Transformation ratio - Ideal and Practical Transformer on No load and Load - Phasor diagrams - Impedance ratio and shifting parameters - Equivalent circuit parameters - Losses and Efficiency- Regulation - Tests: Open circuit and Short circuit –Sumpner's test –All day Efficiency – Auto transformer: Construction and theory – Three phase transformer and connections – Applications.	9
III	**ELECTROMECHANICAL ENERGY CONVERSION** Electro Mechanical energy conversion - Force and Torque equations in magnetic system - Energy in magnetic field system - Field energy and Coenergy - Singly and multiply excited magnetic field systems.	9
IV	**D.C GENERATORS** Construction - Principle of operation - Types of D.C Armature windings - EMF equations Types of D.C Generators - Losses in D.C Machine - Armature reaction and commutation - De magnetizing and Cross magnetizing conductors (AT/Pole) - compensating winding - Methods of improving commutation- Resistance and EMF - Characteristics of DC Generators - Applications.	9
V	**D.C MOTORS** Principle and Working of D.C Motors - Types of DC Motors - Back or Counter emf - Equations – Voltage , Power, Speed and Torque - Efficiency - D.C Motor characteristics - Speed control of DC motors: Flux, Armature and Voltage control methods - Electric Braking - Necessity of starters - three point and four point starter – Testing of D.C Machines - Swinburne's test and Hopkinson's test - DC Motor applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Describe the coupled coil calculate the self and mutually induced emf
CO2:Analyze the operation of transformer in different loading condition
CO3:Explain the concept of field energy and co-energy in single and multiple excited systems
CO4:Demonstrate the construction of D.C machines and operation of DC Generator
CO5:Derive the performance equation of D.C motor under various load condition

TEXT BOOKS:

T1 Nagrath I. J and Kothari D. P. "Electric Machines", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010

T2 B.L Thereja "A Text Book of Electrical Technology", Volume II, S.Chand publications, 2006

REFERENCE BOOKS:

R1 Rohit Mehta & V K Mehta., 'Principles of Electrical Engineering', S. Chand Publishing, 2003.

R2 Syed A. Nasar, "Electric Machines and Power Systems", Volume-I, McGraw Hill International Edition , January 1995.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3202	ELECTRONIC DEVICES AND CIRCUITS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Recall the basics about the electronic devices.
2. Interpret the structure, operation and characteristics of transistors.
3. Analyze various configurations of BJT amplifiers.
4. Infer the basic concepts of large signal amplifiers.
5. Interpret the operations of feedback amplifiers and oscillators.

Unit	Description	Instructional Hours
I	**SEMICONDUCTOR DIODE** PN Junction Diode - Structure, Operation and V-I Characteristics, Diode Current Equation, Application of Diode - Rectifiers: Half Wave and Full Wave Rectifier - Zener Diode: Characteristics, Application of Zener Diode.	9
II	**TRANSISTORS** Junction transistor - BJT: CE, CB and CC configurations, Transistor Biasing Circuits - JFET: Output and Transfer Characteristics, Structure, Operation and Characteristics, of MOSFET and UJT.	9
III	**DESIGN AND ANALYSIS OF SMALL SIGNAL AMPLIFIER** BJT - Transistor Modeling, Hybrid Equivalent Circuit, Small Signal Analysis - Low Frequency Model: CE, CB, CC amplifiers, Differential Amplifier - A.C and D.C Analysis, Single Tuned Amplifiers.	9
IV	**LARGE SIGNAL AMPLIFIERS** Classification of Power Amplifiers, Efficiency of Class A Amplifier and Class B Complementary-Symmetry, Push - Pull Power Amplifiers- Calculation of Power Output, Efficiency and Power Dissipation - Crossover Distortion.	9
V	**FEEDBACK AMPLIFIERS AND OSCILLATORS** Advantages of Negative Feedback - Voltage / Current, Series, Shunt Feedback - Positive Feedback - Condition for Oscillations, RC Phase Shift - Wien bridge, Hartley, Colpitts and Crystal Oscillators.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply the knowledge acquired about electronic devices.
CO2: Summarize the concepts of transistors.
CO3: Transform the acquired skill in designing an amplifier circuit.
CO4: Illustrate the nature of large signal amplifiers.
CO5: Outline the concepts of feedback amplifiers, conditions for oscillation and types of oscillators.

TEXT BOOKS:

T1 R.S Setha, "Applied Electronics" S.Chand Publications, 2008.
T2 David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall Publications,2008.

REFERENCE BOOKS:

R1 Rashid, "Micro Electronic Circuits" Thomson publications, 1999.
R2 Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
R3 Robert L. Boylestad, "Electronic Devices and Circuit theory", Prentice Hall, 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3203	MEASUREMENTS AND INSTRUMENTATION (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Recognize the fundamentals of measurement system.
2. Understand the instruments used for measuring electrical parameters.
3. Examine the D.C and A.C bridges.
4. Enumerate the data storage and display devices.
5. Describe the various transducers and data acquisition system.

Unit	Description	Instructional Hours
I	**CHARACTERISTICS, ERRORS AND STANDARDS OF INSTRUMENTS** Functional elements of an instrument - Static and dynamic characteristics - Errors in measurement - Statistical evaluation of measurement data - Standards and calibration.	9
II	**MEASURING INSTRUMENTS** Principle - Construction - Operation of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters - Single phase and three phase wattmeters and energy meters - Instrument transformer- Instruments for measurement of frequency and phase.	9
III	**COMPARISON METHODS OF MEASUREMENTS** D.C Bridges: Wheatstone - Kelvin double bride - AC bridges: Anderson bridge –Maxwell bridge and Schering bridge - D.C & A.C Potentiometers- Transformer ratio bridge - Self- balancing bridge.	9
IV	**STORAGE AND DISPLAY DEVICES** Introduction - Magnetic disk and tape recorders - XY Recorders- CRT display- Display storage oscilloscope - LED & LCD display - Inkjet and Dot matrix printer.	9
V	**TRANSDUCERS AND DATA ACQUISITION SYSTEMS** Classification of transducers- Resistive transducer - RTD and Strain gauge transducer, Capacitive transducers - Inductive transducers - LVDT- Piezoelectric transducer- Hall effect transducers - Elements of data acquisition - Smart sensor.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustrate the fundamentals of measurement system.
CO2: Analyze the instruments used for measuring electrical parameters.
CO3: Determine the circuit parameters (R, L, C and frequency) using bridges.
CO4: Describe the data storage and display devices.
CO5: Select and use various transducers and data acquisition system.

TEXT BOOKS:

T1 Doebelin. E, "Measurement Systems: Application and Design", 6th Edition, Tata McGraw Hill Private Limited, 2012

T2 Sawhney. A.K, "A Course in Electrical and Electronics – Measurement and Instrumentation", 19th Edition, Dhanpal Rai & Sons, 2014

REFERENCE BOOKS:

R1 D.V.S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, 2007.

R2 H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill, II Edition 2004.

R3 J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, 2003.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3204	ELECTROMAGNETIC THEORY	3	0	0	3

Course Objective

1. Understand the basic concepts in Electrostatics
2. To acquire a complete knowledge in Electrostatics
3. Recognize the concepts in magneto statics
4. Understand the concepts of Electro Dynamic Fields.
5. To know the properties and concepts of Electromagnetic waves.

Unit	Description	Instructional Hours
I	**ELECTROSTATICS – I** Electrostatic fields - sources and effects of electromagnetic fields – Introduction to various coordinate Systems(Cartesian Coordinate, Polar Coordinates) – Vector fields –Vector Calculus Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law Proof of Gauss's law and applications of gauss law.	9
II	**ELECTROSTATICS – II** Potential due to point charge –Electric Field Intensity- Electric field and equipotential points, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.	9
III	**MAGNETOSTATICS** Magnetic field intensity (H) - Lorentz force – Biot–Savart's Law - Ampere's Circuit Law – point form of Ampere's Circuital Law– H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.	9
IV	**ELECTRODYNAMIC FIELDS** Self Inductance and Mutual Inductance - Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current -Maxwell's equations (differential and integral form) Relation between field theory and circuit theory –Applications	9
V	**ELECTROMAGNETIC WAVES** Electromagnetic waves propagation concepts – Plane Electromagnetic wave Equation – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedance and skin depth - Poynting Theorem – Poynting Vector and its Significance – Plane wave reflection and refraction – Standing Wave – Applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply the Vector calculus application in Electromagnetics
CO2: Analyse the concepts of Electromagnetics
CO3: Evaluate the concepts of Magnetostatics
CO4: Analyse the propagation of plane Electromagnetic wave.
CO5: Compare the concepts of Plane wave reflection,refraction and penetration.

TEXT BOOKS:

T1 Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc. First India edition, 2009.

T2 K.A. Gangadhar, P.M. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007.

REFERENCE BOOKS:

R1 Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010

R2 William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.

R3 Kraus and Fleish,"Electromagnetics with Applications"Fifth Edition,Mc Graw Hill International Edition,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3205	POWER PLANT ENGINEERING	3	0	0	3

Course Objective

1. Identify various sources of energy and types of power plants.
2. Describe the layout and various components of operation of hydro electric power plants.
3. Recognize the various components and operation of steam electric power plants.
4. Understand the layout and various components of nuclear power plants.
5. Gain knowledge on various components and operation of diesel and gas power plants

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF POWER PLANT** Introduction to Various Sources of Energy: Conventional and Non Conventional - Classification of Power Plants - Resources for Power Generation - Classification of Power Plant Cycle : Rankine Cycle, Reheat Cycle and Regenerative Cycle - Law of Conservation of Energy.	9
II	**HYDRO POWER PLANTS** Layout of Hydro power plants – Classification of Hydro-Plant – Turbines - Impulse turbines, Reaction turbines and Francis turbine - Run-Off - Selection of site for a hydro-electric power plant – Surface Power house – Under-Ground power house – Types - Advantages & Disadvantages	9
III	**STEAM POWER PLANT** Layout of Steam Power Plants - Fuel and Ash handling systems – Combustion equipment for steam boilers – Mechanical stokers – Pulverized coal and firing – Electrostatic precipitator – IDF and FDF – Steam condensers	9
IV	**NUCLEAR POWER PLANTS** Nuclear energy concepts and terms: Fission, Fusion reaction - Layout of nuclear power plants - Types of Nuclear reactors, pressurized water reactor - Boiling water reactor - Gas cooled reactor – CANDU reactor- Breeder reactor - Chernobyl nuclear power plant	9
V	**DIESEL AND GAS TURBINE POWER PLANTS** Introduction - operating principle – types of IC Engine - Layout of Diesel power plants - Performance of diesel engine - applications. Gas Turbine power plant – Classifications - Elements of gas turbine power plant – Merits –Regeneration and Reheating – Cogeneration-Case study-18th Electric power survey of India.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Select the appropriate power plant and its components based on requirement and Environmental aspects and power plant cycles.
CO2: Explain the concepts of various turbines in hydro power plant and importance of surface and underground power plants.
CO3: Explain the function of various equipments in steam power plant.
CO4: Illustrate the concepts of different types of reactors used in nuclear power plant.
CO5: Explain the function of various equipments in diesel and gas power plants.

TEXT BOOKS:

T1 A.K. Raja.,Amit P. Srivastava.,Manish Dwivedi., "Power Plant Engineering" New age International (P) Limited, Publishers , New Delhi – 110002, 2006
T2 El-Wakil M.M., "Power Plant Technology", 2nd Edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCE BOOKS:

R1 G.D. Rai, "Introduction to Power Plant Technology", 3rd Edition, Khanna Publishers, New Delhi, 2013.
R2 Nag P.K., "Power Plant Engineering", 4th Edition, Tata-McGraw Hill Education, New Delhi, 2014.
R3 R.K. Rajput, "A Text Book of Power Plant Engineering", 4th Edition, Laxmi Publications, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3001	TRANSFORMERS AND DC MACHINES LABORATORY	0	0	4	2

Course Objective

1. Obtain the performances of the DC machines and transformers
2. Conduct experiments on DC Machines to find the characteristics
3. Test the DC machines at different loading conditions
4. Carry out the experiments on transformers
5. Calculate torque and speed of given Machine

EXPT. No	Description of the Experiments
1.	Load test on single phase transformer
2.	Load test on three phase transformer.
3.	Open circuit and short circuit test on single phase transformer.
4.	Open circuit characteristics and Load characteristics of DC shunt generator- critical resistance and critical speed.
5.	Load characteristics of DC compound generator with differential and cumulative compounding connections.
6.	Load test on DC series motor.
7.	Load test on DC shunt motor.
8.	Load test on DC compound motor.
9.	Speed control of DC Shunt motor.
10.	Swinburne's test.
11.	Study of Phasing out test in three phase transformers.
12.	Study of DC motor starters, windings and Commutator.

Total Practical Hours 45

Course Outcome

CO1: Evaluate the efficiency and regulation of transformers from load test and no-load test.
CO2: Conduct the testing and experimental procedures on different types of Electrical Machines
CO3: Experimentally obtain the load characteristics of various DC motors and generators.
CO4: Analyze the operation of Electric Machines under different loading conditions.
CO5: Design and analysis the various speed control technique of electrical machines.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE3002	ELECTRONIC DEVICES AND CIRCUITS LABORATORY (COMMON TO EEE AND EIE)	0	0	4	2

Course Objective

1. Apply the knowledge gained in designing basic electronic circuits
2. Design feedback amplifiers and oscillators
3. Infer the working of cathode ray oscilloscope

Expt. No.	Description of the Experiments
1.	Characteristics of a. Semi conductor diode b. Zener diode
2.	Single Phase half-wave rectifiers with filters
3.	Single Phase full wave rectifiers with filters
4.	Characteristics of Transistor under a. Common Emitter Configuration b. Common Collector Configuration c. Common Base Configurations
5.	Characteristics of JFET and UJT
6.	Design of Relaxation Oscillator
7.	Design and Frequency response characteristics of a Common Emitter amplifier
8.	Design of Feedback Amplifier-Current series
9.	Design of transistor RC phase shift oscillator
10.	Characteristics of photo diode & photo transistor, Study of light activated relay circuit
11.	Realization of first order passive filters
12.	Study of CRO and DSO for phase and frequency measurements
	Total Practical Hours 45

Course Outcome

CO1: Analyze about the characteristics of semiconductor devices
CO2: Experiment the working of rectifier
CO3: Design various electronic circuit configurations
CO4: Demonstrate the frequency response of amplifiers
CO5: Examine the design of current series feedback amplifier and RC phase shift oscillator

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4107	NUMERICAL METHODS (COMMON TO AERO, AUTO, MECH, EEE & EIE)	3	1	0	4

Course Objective

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Apply various methods to find the intermediate values for the given data.
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 Elimination and Gauss Jordan method – Iterative method : Gauss seidel method.	12
II	**INTERPOLATION** Interpolation: Newton's forward and backward difference formulae – Lagrangian interpolation for unequal intervals – Divided difference for unequal intervals : Newton's divided difference formula.	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 and 3/8 rules – 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 and Adam – Bash forth predictor 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: Understand the concept of interpolation in both cases of 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.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4201	INDUCTION AND SYNCHRONOUS MACHINES	3	1	0	4

Course Objective

1. Obtain the performance of three phase induction motor and draw its characteristics.
2. Understand the working of Starters and speed control techniques of three-phase induction motors.
3. Discuss the basic principles and determine the performance of single phase induction motor.
4. Obtain the performance of three phase synchronous generator.
5. Estimate the excitation in synchronous motor at various load conditions.

Unit	Description	Instructional Hours
I	**THREE PHASE INDUCTION MOTORS** Construction - Principle of operation - slip and Frequency of rotor currents - Equivalent circuit - Power across air-gap, Torque & Power output - Torque-slip characteristics - No load and Blocked rotor tests - Circle diagram (approximate) - Cogging and Crawling - Braking: Plugging, dynamic braking and regenerative braking - Induction generator - problems - Applications.	12
II	**STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS** Starting methods of three phase induction motor - Need for starting - Types of starters DOL, Rotor resistance, Autotransformer and Star-Delta starters - Speed control techniques - Voltage control - Pole changing - Frequency control - Rotor resistance control - Slip power recovery schemes	12
III	**SINGLE PHASE INDUCTION MOTORS** Single phase induction motors - Double revolving field theory - Types of single phase induction motors - Split phase motor - Capacitor start motor - Capacitor start and run motor - Shaded pole motor. No load and Blocked rotor test - Equivalent circuit - Applications.	12
IV	**SYNCHRONOUS GENERATORS** Construction - Working of synchronous machine as generator and motor- e.m.f equation - armature reaction - Synchronous reactance - Predetermination of voltage regulation using EMF, MMF, Potier method - parallel operation - Alternator on infinite bus bars - Salient pole synchronous machine - two reaction theory - slip test	12
V	**SYNCHRONOUS MOTOR** Principle of operation - Torque equation - Starting of Synchronous motors - torque and power developed equations - Effect of change in excitation and load on synchronous motor - V curves and inverted V curves - Hunting and suppression methods - damper windings - Synchronous condenser.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Analyze and draw the performance characteristics of the three phase induction motor.
CO2: Demonstrate the starters for starting and control the speed of three phase induction motors.
CO3: State the fundamentals and evaluate the performance of single phase induction motors.
CO4: Apply different methods to obtain the regulation of synchronous generator under various load condition.
CO5: Draw the performance characteristics of synchronous motor under different excitation conditions.

TEXT BOOKS:

T1 D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2006.
T2 P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCE BOOKS:

R1 K. Murugesh Kumar, 'Induction and Synchronous Machines', Vikas Publishing House Pvt. Ltd, 2009.
R2 Fitzgerald Kingsley and Umans, "Electric Machinery" 6th Edition, McGraw Hill Books co., New Delhi, 2002.
R3 Alexander S. Langsdorf, Theory of Alternating-Current Machinery, Tata McGraw Hill Publications, 2001.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4202	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Infer adequate knowledge on IC fabrication procedure.
2. Relate the characteristics of linear integrated circuits and their applications.
3. Apply OP-AMP on various applications like Timers, PLL circuits, ADC's and DAC's.
4. Impart the basic knowledge of regulator circuits and special function IC's.
5. Summarise internal functional blocks of special function IC's.

Unit	Description	Instructional Hours
I	**IC FABRICATION** IC classification - chip size and circuit complexity - fundamental of monolithic IC technology - Silicon wafer preparation - Epitaxial growth – Oxidation - Masking and Etching - diffusion of impurities - Assembly Processing and packaging - Fabrication Diode and FET.	9
II	**CHARACTERISTICS OF OP-AMP** Basic information of OP-AMP - Ideal OP-AMP characteristics - DC characteristics - AC characteristics - frequency response of OP-AMP - Slew Rate - differential amplifier - Basic applications of OP-AMP – Inverting and Non-inverting Amplifiers- summer - differentiator and integrator - V/I & I/V converters.	9
III	**APPLICATIONS OF OP-AMP** Instrumentation amplifier - First order LPF - First order HPF - First order Band pass and Band reject filters - Comparators - multivibrators - waveform generators – clippers – clampers - peak detector- S/H circuit - D/A converter : R- 2R ladder and weighted resistor types - A/D converters : Duel Slope, Successive Approximations.	9
IV	**SPECIAL IC's** Functional block- characteristics & application circuits with IC 555 Timer - Application: Missing pulse detector, PWM, FSK Generator, PPM,SCHMITT Trigger - IC566 voltage controlled oscillator - IC565 - Phase Lock Loop IC - PLL application: frequency multiplication/division, AM Detection.	9
V	**APPLICATION IC's** IC voltage regulators – LM78XX - 79XX Fixed voltage regulators - LM317 - 723 Variable voltage regulators - switching regulator - LM 380 power amplifier - IC8038 function generator - Opto Coupler IC's.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret the IC fabrication procedure.
CO2: Analyze the characteristics of operational amplifiers.
CO3: Outline the applications of OP-AMP.
CO4: Understand the working principle of special IC's.
CO5: Outline the function of voltage regulator as special IC's.

TEXT BOOKS:

T1 D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
T2 S.Salivahanan & V.S. Kanchana Bhaskaran," Linear Integrated Circuits", TMH, 2008.

REFERENCE BOOKS:

R1 Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000
R2 Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition, 2012.
R3 Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4203	DIGITAL LOGIC CIRCUITS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Recall the basic number systems, codes and logical gates.
2. Infer the Boolean algebra and minimization logic.
3. Design combinational circuits.
4. Outline the design of synchronous and asynchronous sequential circuits
5. Write a VHDL Coding for digital circuits

Unit	Description	Instructional Hours
I	**DIGITAL SYSTEM** Binary Numbers – Octal - Hexa Decimal and other base numbers - Number base conversions – complements - signed binary numbers - Floating point number representation - binary codes - error detecting and correcting codes - digital logic gates - Boolean algebra - basic theorems - Boolean functions - canonical and standard forms	9
II	**MINIMIZATION OF LOGIC CIRCUITS** Gate – Level Minimization and combination circuits - The K-Maps Methods - Three Variable - Four Variable - Five Variable - sum of products - product of sums Simplification - Don't care conditions - NAND and NOR implementation and other two level implementation.	9
III	**COMBINATIONAL LOGIC CIRCUITS** Design Procedure - Combinational circuit for different code converters and other problems - Binary Adder – subtractor – Multiplier - Magnitude Comparator – Decoders – Encoders – Multiplexers -Demultiplexers	9
IV	**SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS** Latches - Flip-flops - analysis of clocked sequential circuits - design of counters – Up counters - Down counters - Ripple counters – Registers - Shift registers - Synchronous Counters - Asynchronous Sequential Circuits: Reduction of state and flow tables - Race free state assignment	9
V	**VHDL AND PROGRAMMABLE LOGIC DEVICES** RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages –Subprograms – Test bench. (Simulation / Tutorial Examples: adders, counters, flip-flops, FSM, Multiplexers /Demultiplexers) - Introduction to Programmable Logic Devices: PROM – PLA – PALS	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply knowledge of various number systems and simplify the logical expressions using Boolean functions.
CO2: Evaluate the concepts and minimization of logic circuits.
CO3: Develop combinational circuits.
CO4: Design and analysis synchronous and asynchronous sequential circuits.
CO5: Build VHDL program for adders, counters, flip-flops, FSM, Multiplexers / De-multiplexers

TEXT BOOKS:

T1 Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
T2 M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education 2013.

REFERENCE BOOKS:

R1 Anand Kumar, "Fundamentals of Digital Circuits, PHI, 2013.
R2 John F.Wakerly, 'Digital Design Principles and Practices", 4th edition , PHI Learning Private Ltd.
R3 Albert Paul Malvino Donald P.Leach,"Digital Principles and Applications, 4th edition,Tata Mc Graw-Hill.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4204	TRANSMISSION AND DISTRIBUTION	3	0	0	3

Course Objective

1. Develop expressions for the computation of transmission line parameters.
2. Obtain the equivalent circuits for the transmission lines based on distance and operating voltage.
3. Improve the voltage profile of the transmission system.
4. Analyses the voltage distribution in insulator strings and cables and methods to improve the same.
5. Understand the operation of the different distribution schemes

Unit	Description	Instructional Hours
I	**STRUCTURE OF POWER SYSTEM** Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors –interconnection – EHVAC and HVDC transmission - Introduction to FACTS.	9
II	**TRANSMISSION LINE PARAMETERS** Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines, corona discharges.	9
III	**MODELLING AND PERFORMANCE OF TRANSMISSION LINES** Classification of lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, surge impedance loading, methods of voltage control; Ferranti effect.	9
IV	**INSULATORS AND CABLES** Insulators - Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables - Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables.	9
V	**MECHANICAL DESIGN OF LINES AND GROUNDING** Mechanical design of transmission line – sag and tension calculations for different weather conditions, Tower spotting, Types of towers, SLD of 110/11kV and 230/33kV Substation Layout, Methods of grounding (ICE AND TT).	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Differentiate the types of transmission and distribution systems and illustrate the structure of power system.
CO2: Develop the expressions for calculation of transmission line parameters and their effects.
CO3: Evaluate the performance of transmission line using T and π method.
CO4: Analyze the voltage distribution in insulator strings and cables, identify methods to improve the voltage distribution.
CO5: Analyze and design tower distance in transmission line by computing sag and tension of line conductor.

TEXT BOOKS:

T1 S.N. Singh, Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011
T2 B.R.Gupta, , S.Chand, Power System Analysis and Design'New Delhi, Fifth Edition, 2008.

REFERENCE BOOKS:

R1 C.L.Wadhwa, Electrical Power Systems', New Academic Science Ltd, 2009.
R2 D.P.Kothari , I.J. Nagarath, Power System Engineering', Tata McGraw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
R3 V. K. Mehta and R. Mehta, Principles of Power Systems, S. Chand Publishing, New Delhi 4th edition,2009

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE4205	RENEWABLE ENERGY SOURCES	3	0	0	3

Course Objective

1. Provide knowledge on fundamentals of Energy scenario
2. Introduce the different renewable energy sources
3. Provide knowledge on energy efficient tracking methods
4. Analyze and design processes for bio fuel production.
5. Understand the design concepts of renewable energy sources

Unit	Description	Instructional Hours
I	**INTRODUCTION** World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials – Achievements / Applications – Economics of renewable energy systems.	9
II	**SOLAR ENERGY** Energy available from Sun, Solar radiation data – solar energy conversion into heat, Flat plate and Concentrating collectors – Principle of natural and forced convection – Photo voltaic: p-n junctions, Solar cells, PV systems, Standalone, Grid connected solar power systems – Calculation of energy through photovoltaic power generation.	9
III	**WIND ENERGY** Energy available from wind, General formula, Lift and drag – Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed – Windmill rotors, Horizontal axis and Vertical axis rotors, Determination of torque coefficient, Induction type generators – Working principle of wind power plant.	9
IV	**BIO ENERGY** Biomass conversion – wet and dry processes – Photosynthesis – Materials for Biogas generation – Biogas plants, Drum type, Dome type – Classification of Biomass gasifiers – Alternative Liquid fuels – Ethanol, methanol production – Biomass Applications	9
V	**OTHER RENEWABLE ENERGY** Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro – Geothermal Energy – Hydrogen and Storage – Fuel Cell Systems – Cogeneration – Hybrid Systems.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Investigate the energy economics using research based knowledge
CO2: Demonstrate the applications of solar PV systems
CO3: Illustrate the working of wind energy conversion systems
CO4: Analyze and design processes for bio fuel production.
CO5: Illustrate the working of different non conventional energy sources.

TEXT BOOKS:

T1 Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
T2 Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

REFERENCE BOOKS:

R1 Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
R2 Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
R3 David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4001	INDUCTION AND SYNCHRONOUS MACHINES LABORATORY	0	0	4	2

COURSE OBJECTIVE

1. Study the operation of AC Machines and starters.
2. Determine the losses and performance characteristics in Induction Motor.
3. Determine the regulation of synchronous machines.

EXPT.NO	Description of the Experiments
1.	Load test on three-phase Squirrel cage induction motor/ Slip ring induction motor
2.	No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
3.	Separation of No-load losses of three-phase induction motor
4.	Speed control of three phase Squirrel cage Induction Motor (Stator Voltage control).
5.	Determination of performance parameters of induction motor using circle diagram
6.	Load test on single-phase induction motor.
7.	No load and blocked rotor test on single-phase induction motor.
8.	Regulation of three phase alternator by EMF and MMF method.
9.	Regulation of three phase alternator by ZPF method.
10.	Determination of X_d an X_q for three phase salient pole alternator by slip test.
11	V and Inverted V curves of Three Phase Synchronous Motor.
12.	Study of Induction motor starter (DOL, Automatic Star/Delta)
	Total Practical Hours **45**

Course Outcome

CO1: Perform load test on Induction motors and comment their performance characteristics.
CO2: Predetermine the regulation of three phase alternator by EMF, MMF, and ZPF and slip test.
CO3: Draw the performance characteristics of three phase synchronous motor
CO4: Execute no load and blocked rotor test on induction motors to draw equivalent circuit.
CO5: Analyse and calculate the losses of three phase induction motor

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EEE - HiCET

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE4002	LINEAR AND DIGITAL INTEGRATED CIRCUIT LABORATORY (COMMON TO EEE AND EIE)	0	0	4	2

Course Objective

1. Impart the knowledge on Boolean function/ code converter/ D to A
2. Develop capacity to analyze the functions of encoder and decoder/ multiplexer/ shift register
3. Make the students to understand the functions and characteristics of Op-amp.

S.No	Description of the Experiments
	DIGITAL LOGIC CIRCUITS
1.	Implementation of Boolean Functions, Adder/ Subtractor circuits.
2.	Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa.
3.	Encoders and Decoders.
4.	Multiplexer and De-multiplexer.
5.	Shift Register and Ring Counter.
	ANALOG CIRCUITS
6.	Astable and Monostable multivibrator and using IC 555 timer
7.	Performance characteristics of Op-amp IC.
8.	D/A and A/D Converter.
9.	Application of Op-Amp: Inverting and Non-Inverting amplifier.
10	Application of Op-Amp: Adder and Subtractor.
11.	Application of Op-Amp: Differential amplifier, Integrator and Differentiator
12.	Study of VCO and PLL ICs.
	Total Practical Hours 45

Course Outcome

CO1: Implement the Boolean function and analyze the performance of code conversion.
CO2: Evaluate the functions of D to A converter, encoder and decoder.
CO3: Understand the performance of multiplexer, shift register and ring counters.
CO4: Analyze the performance of Op-amp IC.
CO4: Assimilate the knowledge on VCO and PLL ICS.

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SYLLABUS

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5201	DESIGN OF ELECTRICAL MACHINES	3	0	0	3

Course Objective

1. Describe the fundamental aspects of Specific Loadings of different Electrical Machines.
2. Design and Estimate the Main dimensions of core and windings of DC Machines
3. Estimate and calculate the Cooling tubes for Transformers
4. Determine and analyze the Main dimensions of rotor and end rings of AC Machines.
5. Outline the Different types of Rotors and its windings for Synchronous Machines

S.No	Description of the Experiments	Instructional Hours
I	**INTRODUCTION** Major considerations in Electrical Machine Design - Electrical Engineering Materials – real and apparent flux density of rotating machines - thermal rating: continuous, short time and intermittent short time rating of electrical machines-direct and indirect cooling methods – cooling of turbo alternators.	9
II	**DC MACHINES** Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading – Magnetic Circuits Calculations - Carter's Coefficient - Net length of Iron – Selection of number of poles – Design of Armature – Design of commutator and brushes.	9
III	**TRANSFORMERS** Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.	9
IV	**INDUCTION MACHINES** Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines –Design of rotor bars & slots – Design of end rings – Design of wound rotor - Magnetizing current.	9
V	**SYNCHRONOUS MACHINES** Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters –Estimation of air gap length – Design of rotor –Design of damper winding – Design of field winding – Design of turbo alternators – Rotor design.	9
	Total Instructional Hours	**45**

Course Outcome

CO1 : Apply the choices of specific electric loading and analyze the magnetic loading for different types of Electrical machines
CO2 : Design the main dimensions of core and windings of DC machines using different loading conditions
CO3 : Design the main dimensions of Transformers and able to provide the solutions for the transformer cooling
CO4 : Design the Rotor, Rotor winding using different loading considerations of Induction Motor
CO5 : Analyze the Electric, Magnetic loading for different types of rotors for Synchronous motor

TEXT BOOKS:

T1 A.K Sawhney, "A Course in Electrical Machine Design", DhanpatRai& Sons, New Delhi, 1984.
T2 A Nagoor Kani " A Simplified Text in Electrical Machine Design " RBA Publications, Chennai, 2012.

REFERENCE BOOKS:

R1 M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.
R2 R.K.Agarwal "Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
R3 Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5202	DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING	3	0	0	3

Course Objective

1. Classify signals and systems & their mathematical representation.
2. Analyse the discrete time systems.
3. Describe the various transformation techniques & their computation.
4. Impart knowledge on filters and their design for digital implementation.
5. Study about a programmable digital signal processor & quantization effects.

Unit	Description	Instructional Hours
I	**DISCRETE TIME SIGNALS AND SYSTEMS** Discrete Time Signals-Discrete Time Systems classification of signals-continuous and discrete, energy and power; Classification of systems- Continuous, discrete, linear, causal, stable, dynamic, time variance- Analysis of Discrete Time linear invariant Systems- Discrete Time Systems described by difference equations-correlation of Discrete Time Signals .	9
II	**DISCRETE TIME SYSTEM ANALYSIS** Z-transform and its properties, inverse z-transforms; difference equation – Solution by z transform, application to discrete systems - Stability analysis, frequency response of LTIsystems-inverse systems -Deconvolution .	9
III	**DISCRETE FOURIER TRANSFORM & COMPUTATION** Discrete Fourier Transform- properties – Linear filtering methods –Frequency analysis using FFT Algorithm Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure. Applications of FFT.	9
IV	**IMPLEMENTATION OF DISCRETE TIME SYSTEMS** Structures for realization of discrete time systems-Structure of FIR systems, IIR systems – Quantization of filter coefficients-Parallel & cascade forms. FIR design: Windowing Techniques– Hamming window, Hanning window -Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using bilinear transformation	9
V	**DIGITAL SIGNAL PROCESSORS** Introduction – Computer Architecture of Signal Processing –Van Numann and Harvard Architectures Features – Addressing Formats – TMS320C5x Architecture- Functional modes.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Classify the different types of signals and systems and Analyze a Discrete Time linear invariant Systems.
CO2: Apply z-transform and inverse Z transform and analyze discrete time systems
CO3: Apply Radix-2 Decimation in Time (DIT) and Decimation in Frequency (DIF) FFT Algorithm to Compute Discrete Fourier Transform
CO4: Realize structure and design Infinite Impulse Response (IIR) filters and Finite Impulse Response (FIR) filters.
CO5: Discuss the various architectures of Digital signal processors

TEXT BOOKS:

T1 J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003

T2 S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.

REFERENCE BOOKS:

R1 Nagoorgani.A digital signal processing, Mcgraw hill Education(India) Private Limited, New delhi,2015.

R2 Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE5203	MICROPROCESSORS AND MICROCONTROLLERS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Infer the fundamental components of 8085 architecture.
2. Discuss the assembly language programming with simple examples.
3. Integrate the concept of peripheral's interfacing with assembly language programming.
4. Explain the fundamental architecture of 8051 microcontroller and its programming concepts.
5. Propose the architecture study of advance microprocessors and microcontrollers.

Unit	Description	Instructional Hours
I	**ARCHITECTURE AND MEMORY INTERFACING OF 8085 PROCESSOR** Functional Block Diagram - Pinouts and signals - Memory Interfacing - I/O ports and Interfacing Concepts - Timing Diagram - Interrupts.	9
II	**PROGRAMMING OF 8085 PROCESSOR** Instruction format, Data Transfer, Arithmetic and Logic, Branch, Machine Control Instructions- Addressing Modes - Writing Assembly Language Programming: Loop Structure with Counting & Indexing - Look up table - Stack and Subroutine Instructions Stack-Sample Programs.	9
III	**PERIPHERAL INTERFACING** Study of Architecture and Programming of Peripheral IC's:8255 PPI, 8259 PIC, 8251 USART,8279 Keyboard Display Controller and 8253 Timer/ Counter - 8237 DMA - Interfacing with 8085:A/D & D/A converter.	9
IV	**MICROCONTROLLER 8051** Difference between Microprocessor and Microcontroller - Functional Block Diagram - Pinouts and Signals - Memory Organization - Interrupt Structure – Timer - I/O Ports and Data Transfer concepts - Serial Communication.	9
V	**MICROCONTROLLER PROGRAMMING & APPLICATIONS** Instruction Format - Addressing modes - Simple Programming Exercises - Interfacing: Keyboard and Display, Closed Loop Control of Servo Motor, Stepper Motor, Washing Machine Control.Study of Architecture of PIC Microcontroller, Arduino, Beagle bone, Raspberry pi modules.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret architecture of 8085 microprocessor and 8051 microcontroller
CO2: Observe the programming concept involved in 8085 and 8051.
CO3: Discuss the commonly used peripheral/ interfacing IC's with its programming.
CO4: Outline simple program writing skill for 8051 and its applications.
CO5: Employ the role of advanced microcontrollers and it's module in an embedded industries.

TEXT BOOKS:

T1 Krishna Kant, "Microprocessors and Microcontrollers", Prentice –Hall of India, New Delhi, 2007.
T2 Muhammad Ali Mazidi, Janice G. Mazidi "The 8051 Microcontroller and Embedded System, Pearson Education, 2003

REFERENCE BOOKS:

R1 R.S. Gaonkar, "Microprocessor Architecture Programming and Application", Penran International Publishing Private limited, 5th edition,2010
R2 N.K.Srinath, "8085 Microprocessor Programming and Interfacing", PHI Private Ltd., 2010.
R3 N.Senthi Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers" Oxford press, 2013
R4 William Kleitz, "Microprocessor and Microcontroller: Fundamental of 8085 and 8051 Hardware and Software" Pearson Education, 1998

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE5204	CONTROL SYSTEMS (COMMON TO EEE AND EIE)	3	1	0	4

Course Objective

1. State the different methods of system representations and transfer function models for various systems.
2. Discuss on time response system analysis.
3. Explain about Frequency response system analysis.
4. Establish methods of stability analysis and controller compensators.
5. Outline on advanced and sampled data control systems.

Unit	Description	Instructional Hours
I	**CONTROL SYSTEMS AND THEIR REPRESENTATIONS** Basic elements in control system, Systems and their representation – Open and closed loop systems – Transfer Function models – Mechanical Translational, Rotational systems – Electrical systems – Analogies – mechanical and Electrical analogous systems – Synchros – AC and DC servomotors.	12
II	**TIME RESPONSE ANALYSIS** Block diagram representation, Construction, Block diagram reduction techniques – Signal flow graphs – Standard test signals – Order of a system – impulse, step response of first order systems – second order system(under damped and critically damped) – Time domain specifications – Type Number of control system –Static Error constants – Steady state error .	12
III	**FREQUENCY RESPONSE ANALYSIS** Frequency response –Advantages – Frequency domain specifications, Types – Bode plot – Polar plot – M and N circles – Correlation between frequency and time domain specifications.	12
IV	**STABILITY AND COMPENSATOR DESIGN** Characteristics equation – Routh Hurwitz criterion – Relative and conditional stability, Root locus concept, construction, stability criterion. Effects of P,PI,PID controller modes of feedback control – Compensator – Types – Lag, lead and lag-lead networks – Lag-Lead compensator design using Bode plot.	12
V	**STATE MODELS AND SAMPLED DATA SYSTEMS** Concept of state and state models – State models for linear and time invariant Systems – State model of Armature and Field control system – Concept of Controllability and Observability. Introduction to digital control system, Introduction of Digital Controllers (Qualitative Treatment only).	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply basic knowledge for modeling of mechanical, electrical control systems
CO2: Deduct the different order systems with various inputs and their response
CO3: Estimate the various frequency domain specifications by using phase analysis
CO4: Investigate the open and closed loop control systems stability and stability corrections
CO5: Develop a state models and discrete control systems for any application

TEXT BOOKS:

T1 Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5th Edition, 2010
T2 I.J.Nagrath and M.Gopal, "Control System Engineering," New Age international (P) Ltd, New Delhi, 2006.

REFERENCE BOOKS:

R1 Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 2012.
R2 M.Gopal, "Digital Control and State variable Methods", Tata McGraw-Hill, New Delhi, 2003.
R3 Nagoor Kani A " Control Systems Engineering," RBA publications, Chennai, 2006

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	16IT5231	OBJECT ORIENTED PROGRAMMING USING JAVA (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective	To understand the concepts of Object Oriented Programming To impart the fundamental concepts of core JAVA. To enable the students to gain programming skills in JAVA. To know how to handle exceptions. To understand multithread programming logic

Unit	Description	Instructional Hours
I	INTRODUCTION Object oriented programming concepts – objects-classes- methods and messages-abstraction and encapsulation-inheritance- abstract classes- polymorphism-Benefits of OOP, Application of OOP-Java Evolution-Features of Java-Difference of Java from C and C++.	9
II	OVERVIEW OF JAVA LANGUAGES Basics of Java programming, Data types, constants -Variables and Arrays, Operators and expressions, Decision making and branching –looping – Classes, Objects and Methods- access specifiers – static members –Constructors-this keyword-finalize method.	9
III	PACKAGES AND INTERFACES Java API Packages –Naming conventions-creating, accessing, using Packages- Inheritance– Method Overriding- Abstract class Interfaces: Multiple inheritance-defining, extending, implementing interfaces- -final keyword.	9
IV	EXCEPTION Handling Fundamentals-Exception types –Uncaught exceptions-Using try and catch-Multiple Catch-Nested try-Throws-Finally-Built in Exceptions-Throwing own exceptions.	9
V	MULTITHREAD PROGRAMMING Creating Threads- Extending thread class-Stopping and Blocking Thread-Life cycle –Using Thread-Thread Exceptions-Thread priority-Synchronization-Runnable Interface-Inter thread communication.	9
Total Instructional Hours		45

Course Outcome	CO1: Understand the concepts of OOPs CO2: Design the syntax, semantics and classes in Java language CO3: Analyze object inheritance and its use. CO4: Apply various types of Exception handling CO5: Implement the use of multithread programming.

TEXT BOOKS:

T1 - Herbert Schild, "Java The Complete Reference", Eighth Edition, McGraw Hill, 2011.T2
- Ali Bahrami, "Object Oriented Systems Development", Pearson Education, 2008.

REFERENCE BOOKS:

R1 - E Balagurusamy, "Programming with JAVA", Fifth Edition, McGraw Hill, 2015.
R2 - Michael Blaha, JamesRumbaugh, "Object-Oriented Modeling and Design With UML", Second Edition, Pearson Education, 2008.

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Dean (Academics)
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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE5001	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY (COMMON TO EEE AND EIE)	0	0	4	2

Course Objective

1. Discuss the assembly language programming with simple examples.
2. Integrate the concept of peripheral's interfacing with assembly language programming.
3. Propose the concepts of Industrial drive interfacing concepts with programming.

Expt. No.	Description of the Experiments
1.	Simple arithmetic operations: a. 8-bit addition/subtraction/multiplication/division. b. 16 bit addition/subtraction.
2.	Programming with control instructions: a. Sorting Operations. b. Largest/ Smallest of given numbers. c. Code conversions.
3.	Programming using Rotate and Complement instructions.
4.	Generation of waveforms by interfacing D/A.
5.	Conversion of Analog signal to digital code with A/D interfacing.
6.	Traffic light controller.
7.	Keyboard and 7-segment display interface with 8279.
8.	Interface the stepper motor to perform clockwise and anti-clock wise rotation.
9.	Demonstration of basic function with 8051 microcontroller execution, including a. Conditional jumps b. Calling subroutines.
10.	Programming Practices with 8085 Simulators.
11.	Generation of PWM signal using timer and counter with 8051
12.	Study on a) Raspberry pi/ Arduino based interfacing. b) Stepper motor interfacing
	Total Practical Hours **45**

Course Outcome

CO1:Outline the 8085architecture and its programming execution.
CO2:Implementing interfacing knowledge with different applications.
CO3:Discriminate the programming concepts of 8051 with 8085.
CO4:Simplify the assembly language programming to text based programming with open source compiler.
CO5:Interpret the programming relevant to industrial applications.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5002	CONTROL AND INSTRUMENTATION LABORATORY	0	0	4	2

Course Objective

1. Compare P, PI and PID controllers and stability analysis of linear system.
2. Gain knowledge of different types of bridges.
3. Verify the principles and characteristics of various transducers.

S.No	Description of the Experiments
	CONTROLSYSTEMS:
1.	Estimate the effect of P, PI, PD and PID Controllers on the Linear system.
2.	Design of Lag, Lead and Lag-Lead Compensators.
3.	Transfer Function of Separately Excited D.C Shunt Generator.
4.	Transfer Function of Armature Controlled D.C Motor.
5.	Stability Analysis of Linear Systems using Bode, Root locus & Nyquist plots method using simulation software.
	INSTRUMENTATION:
6.	DC Bridges : Wheatstone bridge and Kelvin double bridge.
7.	AC Bridges : Anderson bridge and Schering bridge.
8.	Measurement of temperature using Thermocouple and RTD.
9.	Measurement of displacement and pressure.
10.	Measurements of Optical Transducer resistance (LDR).
11.	Measurement of Power and Energy.
12.	Design of Instrumentation Amplifier.
	Total Practical Hours 45

Course Outcome

CO1: Estimate the effect of P, PI, PID controllers for the given system specifications.
CO2: Determine the stability analysis of linear systems.
CO3: Deduce the transfer functions of D.C machine.
CO4: Design the AC and DC bridges.
CO5: Analyze the performance characteristics of various transducers.

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Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16IT5031	OBJECT ORIENTED PROGRAMMING LABORATORY (COMMON TO EEE AND EIE)	0	0	4	2

Course Objective

1. Get a clear understanding of object-oriented concepts.
2. Write java programs to solve mathematics, science and engineering problems.
3. Identify compile time and runtime errors, syntax and logical errors
4. Import the essentials of java class library and user defined packages.
5. Make the students to write programs using multithreading concepts and handle exceptions

Expt. No.	Description of the Experiments
	Simple Java Applications
1.	Understanding References to an Instant of a Class
2.	Handling Strings
3.	Concept of class and arrays
4.	Constructor
5.	Overloading and overriding
6.	Inheritance
7.	Developing interfaces- multiple inheritance, extending interfaces
8.	Creating and accessing packages
	Threading
9.	Creation of Threading
10.	Multi-Threading
	Exception Handling Mechanism in Java
11.	Implementing Predefined Exceptions
12.	Implementing User Defined Exceptions
	Total Practical Hours 45

Course Outcome

CO1: Gain the basic knowledge on Object Oriented concepts.
CO2: Ability to develop applications using Object Oriented Programming Concepts.
CO3: Ability to implement features of object oriented programming to solve real world problems.
CO4:Demonstrate simple applications using java
CO5:Implementing various java applications using multithread programming

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6201	POWER SYSTEM ANALYSIS	3	1	0	4

Course Objective

1. Analyze the different aspects of modeling of power system components.
2. Estimate the steady state operation of large scale power systems.
3. Solve the power flow problems using efficient numerical methods suitable for computer simulation.
4. Identify the concept of symmetrical and unsymmetrical faults in power system studies.
5. Analyze the dynamics of power system for small signal and large signal disturbances.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need for power system analysis in planning and operation of power systems - Basic Components of a power system and its modeling- Single line diagram – per phase and per unit analysis – formulation of Y-Bus matrix and Z-Bus matrix.	12
II	**POWER FLOW ANALYSIS** Importance of Power flow analysis - statement of power flow problem - classificationof buses - development of power flow model in complex variables form - iterative solution using Gauss-Seidel method - Q-limit check for voltage controlled buses – power flow model in polar form - iterative solution using Newton-Raphson method - Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart.	12
III	**SYMMETRICAL FAULT ANALYSIS** Need for short circuit analysis - assumptions in fault analysis - Symmetrical short circuit analysis –Thevenin's equivalent representation - Z-bus building algorithm - fault calculations using bus impedance matrix.	12
IV	**UNSYMMETRICAL FAULT ANALYSIS** Fundamentals of symmetrical components – sequence impedances - sequence networks analysis of single line to ground, line to line and double line to ground faults.	12
V	**STABILITY ANALYSIS** Classification of power system stability - Steady and Transient state stability - development of swing equation – solution of swing equation by modified Euler method and Runge-Kutta method - Equal area criterion - determination of critical clearing angle and time.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Develop knowledge on mathematical model of power system components.
CO2: Interpret the mechanisms to address load flow problems in power system.
CO3: Create computational models for analysis symmetrical conditions in power systems.
CO4: Create computational models for analysis unsymmetrical conditions in power systems
CO5: Analyze the stability of the Power System.

TEXT BOOKS:

T1 Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', McGraw-Hill Education India, Fourth Edition, 2011.
T2 Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

REFERENCE BOOKS:

R1 J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, ' Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
R2 John J. Grainger and William D. Stevenson, Jr, 'Power System Analysis', McGraw Hill Education India, First Edition, 2013.
R3 Abhijit Chakrabarti, Sunitha Halder, 'Power System Analysis Operation and Control', PHI Learning Private Limited, Third Edition, 2010

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6202	POWER ELECTRONICS	3	0	0	3

Course Objective

1. Accumulate knowledge in different types of power semiconductor devices and their switching characteristics.
2. Understand the operation, characteristics and performance parameters of controlled rectifiers
3. Study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4. Learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5. Study the operation of AC voltage controller and various configurations.

Unit	Description	Instructional Hours
I	**POWER SEMI-CONDUCTOR DEVICES** Study of switching devices – Construction and working of power semiconductor devices: Diode, SCR,TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.	9
II	**PHASE-CONTROLLED CONVERTERS** 2-pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance– – Gate Circuit Schemes for Phase Control–Dual converters.	9
III	**DC TO DC CONVERTER** Step-down and step-up chopper-control strategy–Forced commutated chopper – Working of four quadrant chopper –Voltage commutated,Current commutated, Load commutated, Switched mode regulators- Buck, Boost, buck-boost converter - Introduction to Resonant Converters	9
IV	**INVERTERS** Single Phase and three phase voltage sourceinverters(bqth120 modeand180 mode)– Voltage&harmonic control-PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM –Introduction to space vector modulation –Current source inverter.	9
V	**AC TO AC CONVERTERS** Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control –Multistage sequence control -single phase and three phase cycloconverters –types of UPS in application-Introduction to Matrix converters. CASE STUDY: "Design and application of driver circuits for power electronics devices (MOSFET/IGBT)"	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to apply Power electronics components in various circuits.
CO2: Able to analyze the various converters.
CO3: Design DC-DC Converters and AC-AC Converters.
CO4: Analyze Pulse width Modulated Inverter.
CO5: Evaluate the working of Matrix inverters.

TEXT BOOKS:

T1 M.H.Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, Third Edition, New Delhi, 2004.

T2 P.S.Bimbra, "Power Electronics",Khanna Publishers, Third Edition, 2003.

REFERENCE BOOKS:

R1 Ned Mohan, Tore. M. Undel and, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, Third edition,2003.

R2 M.D. Singh and K.B. Khanchandani, "Power Electronics",McGraw Hill India, 2013.

R3 Daniel.W.Hart, "Power Electronics", Indian Edition,McGraw Hill Edition, 2011.

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HiCET

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6203	PROTECTION AND SWITCH GEAR	3	0	0	3

Course Objective

1. Educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
2. Introduce the characteristics and functions of relays and protection schemes.
3. Describe the various methods of apparatus protection
4. Introduce static and numerical relays
5. Impart knowledge on functioning of circuit breakers

Unit	Description	Instructional Hours
I	**PROTECTION SCHEMES** Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes-protection against over voltages due to lightning /switching transients.	9
II	**ELECTROMAGNETIC RELAYS** Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays-introduction to static /numerical relays-Contactors AC1,AC3 types.	9
III	**APPARATUS PROTECTION** Current transformers (CT) and Potential transformers (PT) and their applications in protection schemes - Protection of transformer, generator, motor, bus-bars and transmission line-numerical relay-protection schemes for overcurrent and distance protection of transmission line.	9
IV	**THEORY OF CIRCUIT INTERRUPTION** Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current	9
V	**CIRCUIT BREAKERS** Introduction to fuses-Types of circuit breakers – air blast, air break, oil, SF_6 and vacuum circuit breakers-MCB, MCCB and characteristics curves of MCB and MCCB – comparison ofdifferent circuit breakers –testing of Circuit breakers.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze the causes of faults in electrical apparatus and power system.
CO2: Evaluate the characteristics and function of relays.
CO3: To gain knowledge the various apparatus protection techniques and their applications.
CO4: solve the problems associated with the circuit interruptions by circuit breakers.
CO5: Classify the types of circuit breaker and their testing

TEXT BOOKS:

T1 Badri Ram, B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age InternationalPvt Ltd Publishers, Second Edition 2011.

T2 B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International(P) Ltd., First Edition 2011.

REFERENCE BOOKS:

R1 Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.

R2 C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010.

R3 Y.G.Paithnkar /S.R.Bhide "Fundamentals of power system protection".'prentice Halls of India PvtLimited"New Delhi.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE6204	EMBEDDED SYSTEMS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objective

1. Illustrate the design procedure and standards of embedded system
2. Describe the interfacing network components of embedded system.
3. Discussion of Embedded system design technology with various modeling.
4. Review of embedded system design policies via RTOS.
5. Make use of embedded system for developing a real time system application.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO EMB.E.DDED SYSTEMS** Introduction to Embedded Systems – Design process of embedded systems - Structural units in embedded processor, Selection of processor & memory devices - Direct Memory Access - Memory management methods - Timer and Counter, Watchdog Timer, Real Time Clock.	9
II	**EMB.E.DDED NETWORKING** Introduction, I/O Device Ports & Buses – Serial Bus communication Protocols – UART-RS232 standard - RS422/ RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) – USB - Parallel Device Protocols - Need for device drivers.	9
III	**EMB.E.DDED PRODUCT DEVELOPMENT ENVIRONMENT** Embedded Product Development Life Cycle(EDLC) - Objectives, Different Phases of EDLC, Computational models of EDLC- Data Flow Graph, State Machine Model, Sequential Program Model, Concurrent Model, Object Oriented Model – Hardware - software Co-design - issues - Embedded system design technology.	9
IV	**REAL-TIME OPERATING SYSTEM** Introduction to basic concepts of RTOS - Task, process & threads - Interrupt Service Routines, Multiprocessing and Multitasking, Preemptive and Non - preemptivescheduling, Context switching, Task communication- shared memory, message queue - synchronization between processes-semaphores, Mailbox, pipes. Real Time Operating systems: Vx Works, MUCOS-II.	9
V	**EMB.E.DDED SYSTEM APPLICATION** Case Study: Automatic Chocolate Vending Machine (ACVM), Digital Camera, Mobile phone, Washing Machine, Smart card System Application.	9
	Total Instructional Hours	**45**

Course Outcome

CO1. Infer the ample of knowledge about various embedded development Strategies.
CO2. Illustrate the bus/ network communication among processor and I/O interfacing.
CO3. Abstract various multiprocessing scheduling algorithms.
CO4. Explanation of basic knowledge of various RTOS and their feature.
CO5. Employ the role of embedded system on various real-time application.

TEXT BOOKS:

T1 Rajkamal, 'Embedded System-Architecture, Programming and Design', Tata Mc Graw Hill, 3rd Edition, 2015.
T2 Peckol, "Embedded system Design", John Wiley & Sons, 2010.

REFERENCE BOOKS:

R1 Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2009.
R2 Elicia White," Making Embedded Systems", O' Reilly Series,SPD, 2011.
R3 Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6001	POWER SYSTEM SIMULATION LABORATORY	0	0	4	2

Course Objective

To assist the students to acquire power system software development skills and experience in the usage of standard packages necessary for

1. Computation of parameters and modeling of transmission lines
2. Formation of Bus impedance and admittance matrix.
3. Power Flow, Fault Analysis, Economic Load Dispatch, Load Frequency Dynamics and Stability Analysis of Power System.

S.No	Description of the Experiments
1.	Formation of Bus Admittance Matrices
2.	Formation of Bus Impedance Matrices
3.	Load Flow Analysis: Solution of Load Flow and Related Problems Using Gauss-Seidel method
4.	Load Flow Analysis: Solution of Load Flow and similar Problems Using Newton-Raphson method.
5.	Load Flow Analysis: Solution of Load Flow and Problems Using Fast Decoupled method.
6.	Fault Analysis- Symmetrical Fault
7.	Fault Analysis- Unsymmetrical Fault
8.	Economic Load Dispatch without losses
9.	Economic Load Dispatch with losses
10.	Load Frequency Dynamics of Single and Two Area Power Systems
	Total Instructional Hours **45**

Course Outcome

CO1: Develop programs for formation of bus admittance and impedance matrices.
CO2: Formulate programs for Power flow solution using Gauss-Seidel method, Newton Raphson and Fast-Decoupled methods.
CO3: Analyze the short circuit faults in the power system network.
CO4: Know about Economic Load Dispatch in power generating stations on given demand
CO5: Develop knowledge on load frequency dynamics of power system.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6002	POWER ELECTRONICS LABORATORY	0	0	4	2

Course Objective

1. Acquire knowledge in various characteristics of Power Electronics Devices.
2. Able to know the working of AC/DC and AC/AC converter.
3. Provide hands on experience with power electronic converter design and testing.

S.No	Description of the Experiments
1	Gate Pulse Generation using R,RC and UJT.
2	Characteristics of SCR
3	Characteristics of TRIAC
4	Characteristics of MOSFET
5	Characteristics of IGBT
6	AC to DC half controlled converter
7	AC to DC fully controlled Converter
8	Step down and step up MOSFET based choppers
9	IGBT based single phase PWM inverter
10	AC Voltage controller
11	Simulation of PE circuits (1 phase and 3 phase semiconverter,1 phase and 3 phase full converter)
12	Simulation of PE circuits (DC-DC converters)
13	Solar based DC-DC power converter
	Total Instructional Hours **45**

Course Outcome

CO1: Ability to understand and analyze Power electronic circuits.
CO2: Analyse the working of AC/DC Converters
CO3: Evaluate the working of PWM Inverters
CO4: Design various converter circuits in MATLAB
CO5: Use the modern tool MATLAB to develop various circuits in Power Electronics.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE6003	CIRCUITS DESIGN LABORATORY	0	0	4	2

Course Objective

npart knowledge to the students on various electrical and electronic control circuits.
esign and fabrication for Motors and UPS.
btain knowledge on thermal or electromagnetic relay.

S.No	Description of the Experiments
1.	esign and implementation of control circuits for DOL starter and star/delta starter withThermal Over Load Relay.
2.	esign and implementation of speed control circuit for domestic fan using solid state vitching devices.
3.	esign and implementation control circuits for plugging/reversal operation for DC and ACMotor.
4.	esign and testing of linear mode power supply (fixed or variable).
5.	esign and testing of MOSFET driver circuit.
6.	esign and Estimation of Domestic UPS/Solar PV system.
	Total Instructional Hours 5

Course Outcome

O1: Ability to design control circuits for DOL and star/delta circuits.
O2: Analyze and evaluate control circuits for plugging/reversal operation for DC motor.CO3: Acquire knowledge on the haracteristics of thermal/electromagnetic relay.
O4: Becomes capable to fabricate, domestic fan, driver circuit and isolation circuit for microprocessor.CO5: Understand the esign and fabrication of UPS.

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PROFESSIONAL ELECTIVE-I

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5301	POWER SYSTEM TRANSIENTS	3	0	0	3

Course Objective

1. Identify the generation of switching transients and their control using circuit – theoretical concept.
2. Study the mechanism of lighting strokes and the production of lighting surges.
3. Investigate the propagation, reflection and refraction of travelling waves.
4. Apply EMTP for transient computation
5. Assess the impact of voltage transients caused by faults, circuit breaker action and load rejection on integrated power system.

Unit	Description	Instructional Hours
I	**INTRODUCTION AND SURVEY** Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.	9
II	**SWITCHING TRANSIENTS** Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - capacitance switching with a restrike, with multiple restrikes- ferro resonance.	9
III	**LIGHTNING TRANSIENTS** Review of the theories in the formation of clouds and charge formation – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires – tower footing resistance - Interaction between lightning and power system.	9
IV	**TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS** Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewley's lattice diagram – standing waves and natural frequencies - reflection and refraction of travelling waves.	9
V	**TRANSIENTS IN INTEGRATED POWER SYSTEM** The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults – switching surges on integrated system Qualitative application of EMTP for transient computation.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyse the importance and various causes for transients occurring in RL/RLC circuits and model th equivalent circuits for load switching and current chopping phenomena for RLC circuits

CO2: Apply knowledge of science for the lighting phenomena and will be able to design suitable protection systems for power networks

CO3: Apply knowledge of mathematics and engineering fundamentals for calculation of travelling waves on transmission lines and develop various lattice diagrams for the computation of over voltages due to reflection and refraction waves

CO4: Select the modern tools such as EMPT for qualitative application in transients computation

CO5: Analyse various faults like short line and kilometric faults and line dropping and load rejection problems in transmission lines.

TEXT BOOKS: REFERENCE

T1 Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.

T2 Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc.,Second Edition, 2009.

BOOKS:

R1 M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition,2013.

R2 Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5302	FIBRE OPTICS AND LASER INSTRUMENTS	3	0	0	3

Course Objective

1. Understand the properties of optical fibres.
2. Correlate the industrial applications of optical fibres.
3. Recall the fundamentals and types of laser.
4. Summarize the industrial applications lasers.
5. To learn about holography and medical applications of lasers.

Unit	Description	Instructional Hours
I	**OPTICAL FIBRES AND THEIR PROPERTIES** Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.	9
II	**INDUSTRIAL APPLICATION OF OPTICAL FIBRES** Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.	9
III	**LASER FUNDAMENTALS** Fundamental characteristics of lasers – Three level and four level lasers – Properties oflaser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.	9
IV	**INDUSTRIAL APPLICATION OF LASERS** Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.	9
V	**HOLOGRAM AND MEDICAL APPLICATIONS** Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Enumerate the properties of optical fibres.
CO2: Apply the optical fibres for industrial applications.
CO3: Describe the fundamentals and types of laser.
CO4: Choose the lasers for industrial applications.
CO5: Illustrate holography and medical applications of lasers.

TEXT BOOKS: REFERENCE

T1 R.P.Khare, Fiber Optics and Optoelectronics, Oxford university press, 2008.
T2 C.K.Sarkar, Optoelectronics and Fiber Optic Comunication, New Age International (pvt) Ltd,

BOOKS:

R1 Asu Ram Jha, Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems, PHI learning Pvt. Ltd, 2009.
R2 Anuradha De, Optical Fibre and laser principles and applications, Anuradha Agencies, 2004.
R3 John F. Read, Industrial Applications of Lasers, Academic Press, 1978.

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HiCET

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5303	HIGH VOLTAGE ENGINEERING	3	0	0	3

Course Objective

1. Describe the various types of over voltages in power system and protection methods.
2. Impart knowledge on nature of breakdown mechanisms in various dielectrics.
3. Classify the various generating techniques of high AC, DC and Impulse voltage.
4. Summarize the different circuits for high voltage and high current measurement.
5. Explain the high voltage testing of power apparatus and insulation coordination

Unit	Description	Instructional Hours
I	**OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS** Causes of over voltages and its effects on power system – Lightning phenomenon, switching surges and system faults –control of over voltages due to switching - protection of transmission line against over voltages	9
II	**ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS** Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Testing of insulating oils – Breakdown mechanisms in solid and composite dielectrics.	9
III	**GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** Generation of High voltages / currents - DC, AC, impulse voltages and currents.Tripping and control of impulse generators.	9
IV	**MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** Measurement of High DC, AC, impulse voltages and currents – cathode ray oscillographs for Impulse voltages and current measurements.	9
V	**HIGH VOLTAGE TESTING & INSULATION COORDINATION** High voltage testing of electrical power apparatus - Power frequency, impulse voltage and DC testing of Insulators, bushing, circuit breakers, isolators, cables and transformers– Insulation Coordination.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Categorize the various types of over voltages in power system and protection methods.CO2: Analyze the various breakdown mechanisms in different dielectrics.
CO3: Classify the various generating techniques of high AC, DC and Impulse voltage.CO4: Construct the circuits for high voltage and high current measurement.
CO5: Describe the high voltage testing of power apparatus and insulation coordination

TEXT BOOKS:

T1 B M. S. Naidu and V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 5th Edition, 2013.

T2 E. Kuffel and W. S. Zaengel, "High Voltage Engineering Fundamentals", Pergamon Press, Oxford, London, 1986.

REFERENCE BOOKS:

R1 C.L.Wadhwa, "High Voltage Engineering", New Age International Publishers,Third Edition,2012

R2 E. Kuffel and M. Abdullah, "High Voltage Engineering", Pergamon Press, Oxford, 1986.

R3 Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi, Second Edition, 2013.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE5304	PRINCIPLES OF MANAGEMENT	3	0	0	3

Course Objective

1. Expose the students on the evolution of management theory.
2. Create awareness on the function of planning process.
3. Acquire knowledge on organizing techniques.
4. Understand the different types of directing functions.
5. Introduce the concept of controlling function.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS** Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.	9
II	**PLANNING** 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	**ORGANISING** Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.	9
IV	**DIRECTING** Foundations of individual and group behavior – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.	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: Categorize the hierarchy of an organization.
CO2: Discuss the type of plans and understand decision making processes.CO3: Justify the need for organization structure, delegation of authority.
CO4: Describe the organization culture, creativity, leadership, communication etc.
CO5: Estimate budgetary and non budgetary control techniques and understand the processes of controlling

TEXT BOOKS: REFERENCE

T1 Harold Koontz & Heinz Weihrich "Essentials of Management" Tata McGraw Hill, 1998
T2 JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004

BOOKS:

R1 Stephen A.Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
R2 Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
R3 Andrew J.Dubrin , "Essentials of Management", Thompson South Western ,7th edition.

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PROFESSIONAL ELECTIVE-II

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6301	POWER QUALITY	3	0	0	3

Course Objective

1. Introduce the need of power quality.
2. Able to know voltages sags, over voltages and harmonics and methods of control.
3. Acquire Knowledge on overvoltage problems.
4. Study the sources and effect of harmonics in power system.
5. Impart knowledge on various methods of power quality monitoring.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO POWER QUALITY** Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - shortduration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.	9
II	**VOLTAGE SAGS AND INTERRUPTIONS** Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source- analysis and calculation of various faulted condition. Voltage sag due to induction motor starting.Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transferswitches and fast transfer switches.	9
III	**OVERVOLTAGES** Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - linearresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.	9
IV	**HARMONICS** Harmonic sources from commercial and industrial loads, locating harmonic sources.Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion – voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.	9
V	**POWER QUALITY MONITORING** Monitoring considerations - monitoring and diagnostic techniques for various power quality problems -modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools -power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer -flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to understand and analyze power system operation, stability, control and protection.CO2: Evaluate sag and interruptions
CO3: Analyse harmonics and to calculate the values
CO4: Analyse the effects of Over voltages.
CO5: Ability to monitor Power quality and to know the working of measuring instrument.

TEXT BOOKS:

T1 Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill,2003.(For Chapters1,2,3, 4 and 5).

T2 Eswald.F.Fudis and M.A.S.Masoum, "Power Quality in Power System and Electrical Machines," Elseviar Academic Press, 2013.

REFERENCE BOOKS:

R1 G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN,Stars in a Circle Publications, 1994).(For Chapter 1, 2, 3 and 5)

R2 M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (NewYork: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)

R3 G.J.Wakileh, "Power Systems Harmonics – Fundamentals, Analysis and Filter Design," Springer.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6302	FLEXIBLE AC TRANSMISSION SYSTEMS	3	0	0	3

Course Objective

1. Impart knowledge on various reactive power control techniques.
2. Study the design and modeling aspects of static VAR compensators and its applications
3. Recognize the design and modeling of TCSC.
4. Describe various methods of Reactive Power Controls in AC Transmission Lines.
5. Investigate the various FACTS Controllers interaction.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).	9
II	**STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS** Voltage control by SVC – Advantages of slope in dynamic Characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow – Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.	9
III	**THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS** Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.	9
IV	**VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS** Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow studies – UPFC operating principle - mode of operation	9
V	**CO-ORDINATION OF FACTS CONTROLLERS** Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Examine and describe the reactive power control techniques.
CO2: Design and modelling on static VAR compensators and its applications.
CO3: Design and modelling on TCSC and their applications.
CO4: Acquire knowledge on VSC FACTS Controllers and Thyristor controlled series capacitors.CO5: Enumerate various FACTS controller and apply the relevant algorithms in appropriate applications.

TEXT BOOKS:

T1 R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002

T2 Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi- 110 006, 2011

REFERENCE BOOKS:

R1 A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999

R2 V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004

R3 K.R.Padiyar," FACTS Controllers in Power Transmission

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Chairman - BoS
EEE - HiCET

Dean (Academics)
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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6303	SOFTWARE FOR CIRCUIT SIMULATION	3	0	0	3

Course Objective

1. Impart knowledge on The modern simulation tools used for the purpose of circuits design and analysis.
2. Draw and simulate the various power electronics circuits by using different simulation software's.
3. Study the power flow or load flow analysis of various single line diagrams using ETAP.
4. Learn the basics operation and programming codes of MATLAB.
5. Point the basics and fundamental blocks of MATLAB simulink.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems – Review of modeling of power electroniccomponents and basic circuits	9
II	**ADVANCED TECHNIQUES IN SIMULATION** Analysis of power electronic systems in a sequential manner coupled and decoupledsystems – Various algorithms for computing steady state solution in power electronic systems – Future trends in computer simulation.	9
III	**ETAP** Introduction – ETAP overview – AC Elements – DC Elements – One line diagram - Load flow analysis: Tool bars – study case editors – load flow calculation methods - output reports.	9
IV	**MATLAB** Introduction - function description – Data types – Tool boxes – Graphical Display: Import and Export of data – Programs for solution of state equations.	9
V	**SIMULINK** Introduction – Graphical user Interface – Selection of objects – Blocks – linesSimulation - Application programs	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design the basic power electronics circuits through simulation.
CO2: Analysis the various circuits by different algorithm and modern simulations tools. CO3: Design and analysis of the power system load flow analysis technique using ETAP.CO4: Describe the basic coding and data types using MATLAB.
CO5: Design the circuits from the basic blocks and tools of MATLAB.

TEXT BOOKS: REFERENCE

T1 Rashid, M., "Simulation of Power Electronic Circuits using pSPICE" PHI, 2006.
T2 Rajagopalan.V, "Computer aided analysis of power electronic systems" Marcell Dekker 1987.

BOOKS:

R1 John Keown "Microsim Pspice and circuit analysis" Prentice hall Inc, 3rd Edition1998.
R2 Brian Hahn, Daniel T. Valentine, "Essential MATLAB for Engineers and Scientists" 5th Edition , Academic Press, 2013
R3 ETAP Enterprise solution for electrical power systems manual, ETAP 6.0.0.
R4 Matlab / Simulink manual, Maths Work 2007.

Chairman - BoS
EEE - HiCET

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Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6304	PRINCIPLES OF ROBOTICS	3	0	0	3

Course Objective

1. Explain the basics of robotics.
2. Create awareness about the different models for a given Robotic manipulator.
3. Recognize trajectory planning.
4. Classify various type of sensors and machine vision in robotics
5. Observe robot programming and languages

Unit	Description	Instructional Hours
I	**INTRODUCTION** Basics of Robotics, Progressive advancement in Robots, Robot anatomy, Manipulationand control, human arm characteristics, design and control issues, Sensors and vision-programming robots, the future prospects-bio robotics and humanoid robotics.	9
II	**DIRECT KINEMATIC MODEL, INVERSE KINEMATICS AND DYNAMIC MODELING** Mechanical structure and notations, Description of links and joints, Kinematic modelingof manipulator, Denavit-Hartenberg notation, Inverse kinematics- Manipulator workspace, Solution techniques and closed form solution, Dynamic modeling of two degree of freedom manipulator.	9
III	**TRAJECTORY PLANNING** Definitions and planning tasks, Joint space techniques, Cartesian Space techniques, Continuous trajectory recording.	9
IV	**ROBOTIC SENSORS AND MACHINE VISION** Transducers and Sensors, Sensors in Robotics, Tactile Sensors, Proximity and Range Sensors, Miscellaneous Sensors and Sensor-Based System. Uses of sensors in robotics. Machine Vision, the Sensing and Digitizing function in Machine vision, Image processing and Analysis , Training the Vision system, Robotic Applications	9
V	**ROBOT PROGRAMMING AND LANGUAGES.** Method of robot programming, Lead through programming methods, A robot program as a path in space, robot languages- Generation of robot programming and languages, second generation languages, Future generation Languages,Robot language structure,constants, variables and other data objects.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the basics of robotics.
CO2: Develop different model for a given Robotic manipulator.
CO3: Describe the trajectory planning for robotics.
CO4: Generalize role of sensors and machine vision in Robotics.
CO5: Study on robot programming and languages.

TEXT BOOKS:

T1 R.K.Mittal and I.J.Nagrath, Robotics and Control,Tata McGraw Hill,New Delhi,4th Reprint, 2005.
T2 G.P.Groover, M.Weiss,R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCE BOOKS:

R1 Mark W.Sponge, M.Vidyasagar, Robot dynamics and control, Wiley India, 2009.
R2 KS Fu, Ralph Gonzalez CSG Lee, Robotics, John wiley, 2002.
R3 Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.

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OPEN ELECTIVE - I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE6401	INDUSTRIAL AUTOMATION – PLC AND SCADA	3	0	0	3

Course Objectives

1. Discuss the basic concepts involved in Programmable Logic Controllers
2. Interpret the Programmable Logic Controllers programming concepts
3. Cite the applications of Programmable Logic Controllers
4. Outline the basics of SCADA
5. Articulate the various SCADA communications and its applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO PLC** An Overview – Parts of PLC – Principles of Operation – Hardware Components – I/O Section – Discrete I/O Modules – Analog I/O Modules – Specifications – CPU – Memory Types – Human Machine Interface (HMI) – Processor Memory Organization – Program Scan.	9
II	**PLC PROGRAMMING** Basics of Ladder Diagram – Mnemonic Programming Code - Fundamental PLC Programming – Advanced Programming Techniques - Wiring Techniques – Programming Using Timers And Counters.	9
III	**PLC INSTRUCTIONS AND APPLICATIONS** Program Control Instructions – Data Manipulation Instructions – Math Instructions – Sequencer And Shift Register – Motor Controls – Closed Loop And PID Control – Case Studies in PLC.	9
IV	**INTRODUCTION TO SCADA** Evolution – Definition – Architecture - Remote Terminal Units (RTU) -Master Terminal Units (MTU) – Sensors, Actuators And Wiring - Intelligent Electronic Devices (IED) - Operator Interface.	9
V	**SCADA COMMUNICATIONS AND APPLICATIONS** Fundamentals of SCADA Communications – Basics of SCADA Protocols: DNP3, IEC 60870-5 – Ethernet And TCP/IP Networks – Profibus – Foundation Fieldbus. Applications: Substation Automation - Petroleum Wellhead Pump Control – Water Purification System – Crane Control.	9
	Total Instructional Hours	45

Course Outcomes

CO1: Demonstrate the knowledge of Programmable Logic Controllers
CO2: Develop Programs using ladder diagram.
CO3: Correlate the applications of PLC in various domains.
CO4: Summarise the basic concepts involved in SCADA System.
CO5: Analyze about communication standards in SCADA.

TEXT BOOKS:

T1 - F.D. Petruzella, 'Programmable Logic Controllers', Tata Mc-Graw Hill, Third Edition, 2010.

T2 - Stuart A. Boyer, 'SCADA- Supervisory Control and Data Acquisition', The Instrumentation, Systems andAutomation (ISA) Society, USA, Third Edition, 2004.

REFERENCE BOOKS:

R1 - Ronald L.Krutz, 'Securing SCADA Systems', Wiley Publishing Inc. 2006.
R2 - David Bailey, Edwin Wright, 'Practical SCADA for Industry' Newnes - Elsevier Publications, 2003.
R3 - Gordon Clarke, Deon Reynders, 'Practical Modern SCADA protocols', Newnes - Elsevier Publications, 2004.R4 - John R.Hackworth, Frederick D.Hackworth, Jr, 'Programmable Logic Controllers: Programming Methods and Applications', Prentice Hall Publications, First Edition, 2003.

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

Semester – I R2016

Course Code & Name 16MA1101- Engineering Mathematics-I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16PH1101- Engineering Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16CY1101- Engineering Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16HE1101R- Essential English for Engineers -I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16GE1101- Computer Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2

CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16ME1201- Basics of Civil and Mechanical Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16GE1001- Computer Programming Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		2									
CO2	3	3	3	3									2	
CO3	3	3	3	3									2	
CO4	3	3	3	3			2		2			2	2	
CO5	3	3	3	3				0	2	2	2		2	
Avg	3	3	3	2.4	0.4	0	0.4	0	0.8	0.4	0.4	0.4	1.6	0

Course Code & Name 16GE1002- Engineering Practices Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO
CO1														
CO2														
CO3	3	-	-	-	-	-	-	1	1	-	-	1	1	1
CO4														
CO5														
Avg	1	0	0	0	0	0	0	0.333333333	0.333333333	0	0	0.333333333	0.333333333	0.33333

SEMESTER II

Course Code & Name 16MA2102- Engineering Mathematics-II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2

Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16PH2102- Physics of Materials

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16CY2102- Environmental Sciences

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16HE2102R- Essential English for Engineers -II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16GE2102- Engineering Graphics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	1	-	-	-	-	-	-	-	-	1	1
CO2	1	1	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	1	-	-	-	3	3
CO4	-	1	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	2
Avg	1.4	2	2	1.2	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16EE2201- Electrical Circuit Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2

CO1	3				-	-	-	-	1	-	-	-	1	1
CO2	2				-	-	-	-	-	-	-	-	2	2
CO3	3	2			-	-	-	-		-	-	-	3	3
CO4	3	2		-	-	-	-	-	-	-	-	-	1	1
CO5	3	2			-	-	-	-	-	-	-	1	2	2
Avg	2.8	1.2	0	0	0	0	0	0	0.2	0	0	0.2	1.8	1.8

Course Code & Name 16EE2001- Electrical Circuit Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3			3									3	
CO2	2			3									3	
CO3	3			3									3	
CO4	3			3									3	2
CO5	3			3									3	2
Avg	2.8	0	0	3	0	0	0	0	0	0	0	0	3	0.8

SEMESTER III

Course Code & Name 16MA3103- Fourier Analysis and Statistics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
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

Course Code & Name 16EE3201- Transformers and DC Machines

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2											2	
CO2	3	2											1	
CO3	3	3											1	
CO4	3	3											2	
CO5	3	3											2	
Avg	3	2.6											1.6	

Course Code & Name 16EE3202- Electronic Devices and Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3

CO2	1											2	3
CO3	3	2	2									3	2
CO4	2	1										3	3
CO5	2	1	1									3	3
Avg	2	1.25	1.5									2.6	2.8

Course Code & Name 16EE3203- Measurements and Instrumentation

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3											2		
CO2	3	2	2			2							1	
CO3	3		2										2	
CO4	2	3												
CO5	2	2		2									1	
Avg	2.6	2.3	2	2		2						2	1.3	

Course Code & Name 16EE3204- Electromagnetic Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3												1	
CO2	2												3	
CO3	3	2											2	
CO4	3	2											3	
CO5	2	2											3	
Avg	2.6	2											2.4	

Course Code & Name 16EE3205- Power Plant Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	3	3		2									2
CO2	3	3	3		3									2
CO3	3	3	3		3	2								2
CO4		2	3		3	2								2
CO5		2	3		3	2								2
Avg	2.6	2.6	3		2.8	2								2

Course Code & Name 16EE3001- Transformers and DC Machines Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1								3	1			2	
CO2	2								3	1			2	
CO3	3								3	1			2	
CO4	2								3	1			2	
CO5	2								3	1			3	
Avg	2								3	1			2.2	

Course Code & Name 16EE3002- Electronic Devices and Circuits Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2							3					3
CO2	2		2						3					3
CO3	3		3						3					3
CO4	3								3					2
CO5	3								3				3	3
Avg	2.8	2	2.5						3				3	2.8

SEMESTER IV

Course Code & Name 16MA4107 - Numerical Methods

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
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

Course Code & Name 16EE4201- Induction and Synchronous Machines

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	
CO2	3													
CO3	2													
CO4	3	1											2	
CO5	2	1												
Avg	2.4	1											1.5	

Course Code & Name 16EE4202- Linear Integrated Circuits and Applications

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	3										1	
CO2	3	2	3										3	
CO3	3	2	3										3	
CO4	3	2	3										3	
CO5	3	2	3											
Avg	3	2	3										2.5	

Course Code & Name 16EE4203- Digital Logic Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		2								2	
CO2	3	3	3											3
CO3	3	2	3										2	
CO4	3	1	3										2	3
CO5	3	1	3		1									3
Avg	3	2	2.8		1.5								2	3

Course Code & Name 16EE4204- Transmission and Distribution

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	2	2											1	
CO3	2	3											1	
CO4	3	3												1
CO5	2	2												1
Avg	2.2	2.5											1	1

Course Code & Name 16EE4205- Renewable Energy Sources

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2		3		2	3								
CO2	3		3		2									2
CO3	3		3		2									2
CO4	2		3		2									2
CO5	2		3		2									2
Avg	2.4		3		2	3								2

Course Code & Name 16EE4001- Induction and Synchronous Machines Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1		3	3		3	2							1	
CO2		3	3		3	2							2	
CO3		3	3		3	3							1	
CO4		3	3		3	3							2	
CO5			2										3	
Avg		3	2.8		3	2.5							1.8	

Course Code & Name 16EE4002- Linear and Digital Integrated Circuits Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1		2							3				3	
CO2	2	3							3				2	
CO3	3	2							3				3	
CO4		3							3				3	
CO5	2								2				2	
Avg	2.33	2.5							2.8				2.6	

Semester – V

Course Code & Name -16EE5201- Design of Electrical Machines

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	2	2	2	2									2	
CO3	2	2	2	2									2	
CO4	3	3	2	2									2	
CO5	2	2	2											
Avg	2.4	2.2	2	2									2	

Course Code & Name -16EE5202- Discrete Time Systems and Signal Processing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2										3	
CO2	3	3	2										3	2
CO3	3	3	3	1									3	2
CO4	3	3	3										2	3
CO5	3	3		2									2	3
Avg	3	3	2.5	1.5									2.6	2.5

Course Code & Name -16EE5203- Microprocessors and Microcontrollers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1	2										1	
CO2	2	2											3	1
CO3	1		3										3	2
CO4	1		3										3	2
CO5	2		3										3	3
Avg	1.6	1.5	2.75										2.6	2

Course Code & Name- 16EE5204- Control Systems

PO& PSO	PO1	PO2	PO3		PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	1	2									1	3	2	3
CO2	2	1	3										2	2	2
CO3	2	3	1		2								3	3	2
CO4	1		2	3	2							2	3	3	1
CO5	3	3	3		3							2	2	1	3
Avg	2.2	2	2.2	3	2.33							1.66	2.6	2.2	2.2

Course Code & Name -16IT5231- Object Oriented Programming using Java

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1												2	2
CO2	1	2	2	1									2	2
CO3	1		2	2	2				1	1			2	2
CO4	1		2	2	2								2	2
CO5	1		2	3	2				2	2			2	2
Avg	1	2	2	2	2				1.5	1.5			2	2

Course Code & Name -16EE5302- Fibre Optics and Laser Instruments

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2		2									1	2
CO2	2	2	3										1	2
CO3	3	2	2											2
CO4	2		3											3
CO5	2		2	3										3
Avg	2.2	2	2.5	2.5									1	2.4

Course Code & Name -16EE5001- Microprocessors and Microcontrollers Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2							2				1	
CO2	3		2	2					2			2	2	1
CO3	2	2							2				1	1
CO4	3		2	2	1				3			2	2	
CO5	3	2	2	2					3			2	2	2
Avg	2.8	2	2	2	1				2.4			2	1.6	1.3

Course Code & Name-16EE5002- Control and Instrumentation Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		3	3	3								3	2
CO2	3		3	3	3								2	
CO3	3	3	3										2	
CO4	3	3	3										2	
CO5	3	3	3										2	
Avg	3	3	3	3	3								2.2	2

Course Code & Name -16IT5031- Object Oriented Programming Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1												2	2
CO2	1	2	2	1									2	2
CO3	1		2	2	2				1	1			2	2
CO4	1		2	2	2								2	2
CO5	1		2	3	2				2	2			2	2
Avg	1	2	2	2	2				1.5	1.5			2	2

Course Code & Name -16EE6201- Power System Analysis

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2		2										
CO2		3	2	2	2								2	
CO3		3	2	2									2	
CO4		3		2									2	
CO5		3		2									3	
Avg	3	2.8	2	2	2								2.25	

Course Code & Name -16EE6202- Power Electronics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		3										2	
CO2	1	3	2		2								2	
CO3	2	1	3		2								3	
CO4	2	3	1		1								2	
CO5	2	2	2		2									
Avg	2	2.25	2.2		1.75								2.25	

Course Code & Name -16EE6203- Protection and Switchgear

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2				2	3	2		2	
CO2	3	3		2	2				2	3	2	2	2	2
CO3	3	3							3	2			2	
CO4	3	3	2	2	2				2	3	2	2	2	2
CO5	3	3			2				2	3	2	2	2	2
Avg	3	3	2	2	2				2.2	2.8	2	2	2	2

Course Code & Name -16EE6204- Embedded Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		3											
CO2		3			3					3				
CO3		3					2				3	3		
CO4	1												3	3
CO5	2												3	
Avg	2	3	3		3		2			3	3	3	3	3

Course Code & Name -16EE6302- Flexible AC Transmission Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	1		2											
CO3	1			1										1
CO4	1		2	1									2	1
CO5	1		2	1										1
Avg	1		2	1									2	1

Course Code & Name -16EE6001- Power System Simulation Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1			3		3				3				2	2
CO2	1				3				2				3	2
CO3		3			3				3				3	2
CO4		3			3				2				3	3
CO5			3		3				3				3	2
Avg	1	3	3		3				2.6				2.8	2.2

Course Code & Name -16EE6002- Power Electronics Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		2	2	2									
CO2	3	2	3	2	2								3	
CO3	3	2	2	2	2								3	3
CO4	3	2	3	2	2								3	3
CO5	3	2	3	2	2								2	3
Avg	3	2	2.6	2	2								2.75	3

Course Code & Name -16EE6003- Circuits Design Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2							2				1	
CO2	3		2	2	1				2			2	2	1
CO3	2	2	2		2				2			2	1	1
CO4	3		2	2	1				3			2	2	
CO5	3	2	2	2	2				3			2	2	2
Avg	2.8	2	2	2	1.5				2.4			2	1.6	1.3

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