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

2020-2021

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.

Chairman - BoS
EEE - HiCET

Chairman

Dean (Academics)
HiCET

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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ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

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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

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)
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (UG)

REGULATION- 2016 & 2019

REGULATION- 2019

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER – I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1103	Calculus and Differential Equations	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8	19HE1072	**Career Guidance Level – I** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
9	19HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
			Total :	**15**	**2**	**12**	**20**	**550**	**350**	**900**

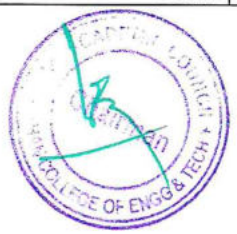
SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2102	Complex Variables and Transform Calculus	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH2151	Material Science	BS	2	0	2	3	50	50	100
4	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	19CS2152	Essentials of C & C++ Programming	ES	2	0	2	3	50	50	100
6	19EE2151	Circuit Theory	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9	19HE2072	**Career Guidance Level – II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
			Total :	**15**	**2**	**14**	**22**	**500**	**400**	**900**

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

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	25	75	100
2	19EE3201	Electronic Devices and Circuits	PC	3	1	0	4	25	75	100
3	19EE3202	Electrical Machines I	PC	3	0	0	3	25	75	100
4	19EE3203	Field Theory	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19EE3251	Electrical and Electronic Measurements	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19EE3001	Electronic Devices and Circuits Laboratory	PC	0	0	3	1.5	50	50	100
7	19EE3002	Electrical Machines Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
			Total	**16**	**2**	**8**	**20**	**350**	**450**	**800**



SEMESTER IV

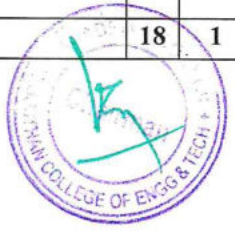
S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	19EE4201	Electrical Machines II	PC	3	1	0	4	25	75	100
3	19EE4202	Integrated Circuits and its Applications	PC	3	0	0	3	25	75	100
4	19EE4203	Digital Signal Processing	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19EE4251	Digital Logic Circuits	PC	2	1	2	4	50	50	100
PRACTICAL										
6	19EE4001	Electrical Machines Laboratory II	PC	0	0	3	1.5	50	50	100
7	19EE4002	Integrated Circuits Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
			Total	**16**	**3**	**8**	**21**	**350**	**450**	**800**

REGULATION-2016

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

SEMESTER V

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



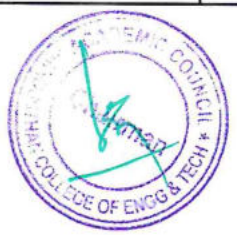
SEMESTER VI

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

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



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

SEMESTER VII

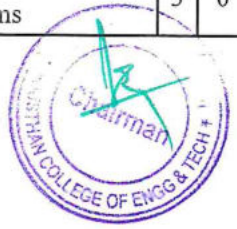
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16EE7201	Solid State Drives	3	0	0	3	25	75	100
2	16EE7202	Electrical Energy Utilization and Conservation	3	0	0	3	25	75	100
3	16EE7203	Power System Operation and Control	3	0	0	3	25	75	100
4	16EE73XX	Professional Elective – III	3	0	0	3	25	75	100
5	16EE73XX	Professional Elective - IV	3	0	0	3	25	75	100
6	16XX74XX	Open Elective - II	3	0	0	3	25	75	100
7	16EE7001	Drives and Control Laboratory	0	0	4	2	50	50	100
8	16EE7701	Technical Seminar	0	0	4	2	0	100	100
9	16EE7702	Industrial Training / Internship	0	0	0	1	0	100	100
		Total Credits:	**18**	**0**	**8**	**23**	**200**	**700**	**900**

SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16EE83XX	Professional Elective – V	3	0	0	3	25	75	100
2	16EE83XX	Professional Elective - VI	3	0	0	3	25	75	100
3	16EE8901	Project Work	0	0	20	10	100	100	200
Total Credits:			**6**	**0**	**20**	**16**	**150**	**250**	**400**

LIST OF PROFESSIONAL ELECTIVES

ELECTIVE III									
1	16EE7301	Microcontroller Based System Design	3	0	0	3	25	75	100
2	16EE7302	Micro Electro Mechanical Systems	3	0	0	3	25	75	100
3	16EE7303	Solar Photo Voltaic Fundamentals & Applications	3	0	0	3	25	75	100
4	16EE7304	Professional Ethics	3	0	0	3	25	75	100
ELECTIVE IV									
1	16EE7305	Advanced Control Theory	3	0	0	3	25	75	100
2	16EE7306	Intelligent Control Techniques	3	0	0	3	25	75	100
3	16EE7307	Communication Engineering	3	0	0	3	25	75	100
4	16EE7308	Special Electrical Machines	3	0	0	3	25	75	100
ELECTIVE V									
1	16EE8301	Application of Power Electronics for Renewable Energy Systems	3	0	0	3	25	75	100



2	16EE8302	Biomedical Instrumentation	3	0	0	3	25	75	100
3	16EE8303	Power System Dynamics	3	0	0	3	25	75	100
4	16EE8304	Energy Management and Electrical Safety	3	0	0	3	25	75	100
ELECTIVE VI									
1	16EE8305	Computer Aided Design of Electrical Apparatus	3	0	0	3	25	75	100
2	16EE8306	Industrial Electronics	3	0	0	3	25	75	100
3	16EE8307	High Voltage Direct Current Transmission	3	0	0	3	25	75	100
4	16EE8308	Total Quality Management	3	0	0	3	25	75	100

OPEN ELECTIVE									
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	16EE7401	Lab VIEW for Engineering Applications	3	0	0	3	25	75	100
2	16EE7403	Basics of Solar Photovoltaic Systems	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

R2016

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

R2019

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

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

HINDUSTHAN ACADEMIC COUNCIL Chairman COLLEGE OF ENGG & TECH

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.	19HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objectives

1. To facilitate students to communicate effectively with coherence.
2. To train the learners in descriptive communication.
3. To introduce professional communication.
4. To enhance knowledge and to provide the information on corporate environment.
5. To equip the trainers with the necessary skills on critical thinking.

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

Course Outcomes

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

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2021.

REFERENCE BOOKS:

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

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ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

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

Course Objectives

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

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

Course Outcomes

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

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1- Thomas & Finney "Calculus and Analytic Geometry", Sixth Edition,,Narosa Publishing House, New Delhi.
R2 - Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition,Pearson India 2016.
R3 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

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HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

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

Course Objectives

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

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment-**Determination of Young's modulus by uniform B.E.nding method.**	6+3
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment. **Determination of Rigidity modulus – Torsion pendulum.**	6+3
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and it's applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. **Determination of wavelength of mercury spectrum – spectrometer grating. Determination of thickness of a thin wire – Air wedge method.**	6+6
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO2 laser- Laser Applications – Holography – Construction and reconstruction of images. **Determination of Wavelength and particle size using Laser.**	6+3
V	**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) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	**45**

Course Outcomes

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objective

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

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

Course Outcome

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

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

CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.

CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.

CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCE BOOKS

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

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

Course Objectives

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

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance B.E.tween two points.**	7+2
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numB.E.rs, linear search, binary search.**	5+4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	3+6
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	5+4
	Total Instructional Hours	**45**

Course Outcomes

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

TEXT BOOKS:

T1 - Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2017.

T2 - S.Annadurai, S.Shankar, I.Jasmine Selvakumari Jeya, M.Revathi, Fundamentals of Python Programming, McGraw Hill Publications, 2021.

REFERENCE BOOKS:

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

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME1152	ENGINEERING DRAWING	1	0	4	3

Course Objectives

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

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	6
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).	6
III	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** 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.	6
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.	6
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Perspective projection of solids in simple position using visual ray method.	6
	Total Instructional Hours	**30**

Course Outcomes

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
CO2: Draw the orthogonal projections of straight lines and planes.
CO3: Interpret the projections of simple solid objects in plan and elevation.
CO4: Draw the projections of section of solids and development of surfaces of solids.
CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOK:

T1- K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th Edition New Age International Publishers, New Delhi 2016.
T2- K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCES:

R1- Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited,New Delhi 2013.
R2- N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1071	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	Course title	L	T	P	C
B.E.	19HE1072	CAREER GUIDANCE LEVEL I	2	0	0	0
		Personality, Aptitude and Career Development				

Course Objectives:

- Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO 1]
- Train students on essential grammar for placements [SLO 2]
- Introduce students on scientific techniques to pick up skills [SLO 3]
- Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one's career with placements in mind [SLO 4]

Expected Course Outcome:
Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

Student Learning Outcomes (SLO): 1, 2, 3 and 4

Module:1 Lessons on excellence **2hours** **SLO:3**
Skill introspection, Skill acquisition, consistent practice

Module:2 Logical Reasoning **11 hours** **SLO:1**
Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles
Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail
Picture and word driven Qs to develop attention to detail as a skill

Module:3 Quantitative Aptitude **11 hours** **SLO:1**
Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4 Recruitment Essentials 2hours SLO:4

Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5 Verbal Ability 4hours SLO:2

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

Total Lecture hours: 30hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE1073	ENTREPRENEURSHIP & INNOVATION	1	0	0	0

Course Objective`

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5: To make students understand organizational performance and its importance.

Module	Description	Instructional Hours
1.	Entrepreneurial Thinking	
2.	Innovation Management	
3.	Design Thinking	
4.	Opportunity Spotting / Opportunity Evaluation	
5.	Industry and Market Research	
6.	Innovation Strategy and Business Models	
7.	Financial Forecasting	
8.	Business Plans/ Business Model Canvas	
9.	Entrepreneurial Finance	
10.	Pitching to Resources Providers / Pitch Deck	
11.	Negotiating Deals	
12.	New Venture Creation	
13.	Lean Start-ups	
14.	Entrepreneurial Ecosystem	
15.	Velocity Venture	
	Total Instructional Hours	**15**

Course Outcome

CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3: Remember effectively and efficiently the potential of new business opportunities.
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment.

TEXT BOOKS:

T1: Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition(2016).

REFERENCE BOOKS:

R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition 2007
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second (2017).
R3: Jonahan Wilson "Essentials of Business Research", Sage Publication, First Edition, (2010).

WEB RESOURCES:

W1: https://blof.forgeforward.in/tagged/startup-lessons
W2: https://blof.forgeforward.in/tagged/entrepreurship
W3: https://blof.forgeforward.in/tagged/minimum-viable-product
W4: https://blof.forgeforward.in/tagged/minimum-viable-product
W5: https://blof.forgeforward.in/tagged/innovation
W6:https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwlwn7fdnXe6

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

Course Objectives

1. To introduce to business communication.
2. To train the students to react to different professional situations.
3. To make the learner familiar with the managerial skills
4. To empower the trainee in business writing skills.
5. To learn to interpret and expertise different content.

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

Course Outcomes

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA2102	COMPLEX VARIABLES AND TRANSFORM CALCULUS (COMMON TO EEE, EIE AND BM)	3	1	0	4

Course Objectives

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Identify effective mathematical tools for the solutions of partial differential equations.
3. Describe the construction of analytic functions and conformal mapping.
4. Illustrate Cauchy's integral theorem and calculus of residues.
5. Analyze the techniques of Laplace and Inverse Laplace transform.

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 – Definition – Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by the 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.	12
III	**COMPLEX DIFFERENTIATION** Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
IV	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem.	12
V	**TRANSFORM CALCULUS** Laplace transform –Basic properties – Transforms of derivatives and integrals of functions - Transform of periodic functions - Inverse Laplace transform - Convolution theorem (with out proof) – Solution of linear ODE of second order with constant coefficients using Laplace transforms.	12
	Total Instructional Hours	**60**

Course Outcomes

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies.
CO2: Solve Partial Differential Equations using various methods.
CO3: Infer the knowledge of construction of analytic functions and conformal mapping.
CO4: Evaluate real and complex integrals over suitable closed paths or contours.
CO5: Apply Laplace transform and its properties to solve certain linear differential equations.

TEXT BOOKS:

T1 -Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2 -Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, Wiley India Private Ltd., New Delhi, 2018

REFERENCE BOOKS :

R1- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.
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.

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

Course Objectives

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

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

Course Outcomes

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Objectives

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

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

Course Outcomes

CO1: Develop an understanding of different natural resources including renewable resources.
CO2: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO3: Understand the causes of environmental pollution and hazards due to manmade activities.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1 - Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2021.
T2 – S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2018.

REFERENCES:

R1 - Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015.
R2 - G.Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 - Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

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

Course Objective

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

Unit	Description	Instructional Hours
I	**BASICS OF 'C' PROGRAMMING** Fundamentals of ' C' programming – Structure of a 'C' program – Constants - Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations-Branching and Looping - Arrays – One dimensional and Two dimensional arrays. **Programs: 1. Write a C program to calculate sum of individual digits of a given numB.E.r. 2. Write a C program to count no. of positive numB.E.rs, negative numB.E.rs and zeros in the array. 3. Write a C program to find sum of two numB.E.rs using functions with arguments and without return type.**	3+6
II	**BASICS OF 'C++' PROGRAMMING** Introduction to C++ – structures and unions- Object oriented programming concepts–Defining a Class – creating objects - access specifiers – Function in C++ - function and data members default arguments – function overloading – Inline functions - friend functions – constant with class – static member of a class – nested classes – local classes. **Program: Write a C++ program to accept the student detail such as name and 3 differentmarks by get_data() method and display the name and average of marks using display() method. Define a friend class for calculating the average of marks using the method mark_avg().**	6+3
III	**CONSTRUCTOR AND OPERATOR OVERLOADING** Constructors - Default, Copy, Parameterized, Dynamic constructors, Default argument – Destructor. - Function overloading- Operator overloading-Unary, Binary - Binary operators using friend function. **Program: Write a C++ program to calculate the volume of different geometric shapes like cuB.E., cylinder and sphere and hence implement the concept of Function Overloading.**	7+2
IV	**INHERITANCE AND POLYMORPHISM** Inheritance – Public, Private and Protected derivations– Single– Multiple– Multilevel– Hybrid– Hierarchical - Virtual base class – abstract class – composite objects- Runtime polymorphism – virtual functions – pure virtual functions. **Program: Demonstrate Simple Inheritance concept by creating a base class FATHER with data memB.E.rs SurName and BankBalance and creating a derived class SON, which inherits SurName and BankBalance feature from base class but provides its own feature FirstName and DOB. Create and initialize F1 andS1 objects with appropriate constructors and display the Father & Son details. (Hint : While creating S1 object, call Father base class parameterized constructor through derived class by sending values).**	7+2
V	**TEMPLATES AND EXCEPTION HANDLING** Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception. **Program: Write a C++ program to create a template function for Bubble Sort and demonstrate sorting of integers and doubles.**	7+2
	Total Instructional Hours	**45**

Course Outcomes

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

TEXT BOOKS:

T1 - E.Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2016.
T2 - E.Balagurusamy, "Object Oriented Programming with C++", 7th Edition, McGraw Hill Publication, 2017.

REFERENCE BOOKS:

R1 - Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
R2 - RohitKhurana, "Object Oriented Programming with C++", Vikas Publishing, 2nd Edition, 2016.
R3 - B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EE2151	CIRCUIT THEORY	2	0	2	3

Course Objective

1. Understand electric circuits and solve complex circuits.
2. Impart knowledge on various network theorems in DC circuits.
3. Provide knowledge on resonance phenomenon and analyze coupled circuits.
4. Impart knowledge on transient response to RL,RC and RLC circuits.
5. Understand the concepts of three phase circuits and three phase power measurement.

Unit	Description	Instructional Hours
I	**BASIC CIRCUITS ANALYSIS** Ohm's Law Kirchoff's laws – Resistors in series and parallel circuits- Source transformation– Voltage and current division- DC and AC Circuits –Power and Power factor- Mesh current and Node voltage method –Super Mesh-Super Node Analysis **- Experimental verification of Kirchoff's Laws**	6+3
II	**NETWORK REDUCTION AND NETWORK THEOREMS FOR DC CIRCUITS** Star delta conversion- Superposition Theorem – Thevenin's and Norton & Theorem – Maximum power transfer theorem –Reciprocity Theorem - Millman's Theorem - **Experimental verification of Network Theorems**	6+3
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 **- Simulation of resonance circuits.**	6+3
IV	**TRANSIENT RESPONSE** Transient response of RL, RC and RLC Circuits using Laplace transform for DC input - Time constants for RL,RC and RLC circuits **- Simulation of transient circuits.**	6+3
V	**THREE PHASE CIRCUITS** Three phase balanced / unbalanced voltage sources – analysis of three phase circuit with balanced supply and balanced load – phasor diagram of voltages and currents – power measurements using two wattmeter method – **Implementation of power measurement using two wattmeter method.**	6+3
	Total Instructional Hours	**30+15**

Course Outcomes

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: Evaluate the three phase power measurement in balanced circuits.

TEXT BOOKS:

T1 William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 8th edition, New Delhi, 2012.

T2 A.Sudhakar , Shyammohan S Palli, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill publishers, 8th edition, 2015.

REFERENCE BOOKS:

R1 Joseph A. Edminister, Mahmood Nahri, "Electric Circuits", Schaum'sseries, Tata McGraw-Hill, 2013.

R2 Chakrabarti A, "Circuit Theory - Analysis and Synthesis Dhanpat Rai & Co,7th Revised Edition,2018.

R3 T.Nageswara Rao "Circuit Theory" AR Publication,Chennai,2017.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19ME2001	ENGINEERING PRACTICES (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)

CIVIL AND MECHANICAL ENGINEERING PRACTICES

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

Total Practical Hours 45

GROUP B (ELECTRICAL)

ELECTRICAL ENGINEERING PRACTICES

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

Total Practical Hours 45

Course Outcome:
CO1: Fabricate wooden components and pipe connections including plumbing works.
CO2: Fabricate simple weld joints.
CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.

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

(COMMON TO ALL BRANCHES)

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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Programme	Course code	Course title	L	T	P	C
B.E.	19HE2072	CAREER GUIDANCE – LEVEL II Personality, Aptitude and Career Development	2	0	0	0

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

Expected Course Outcome:

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes (SLO): 6, 7, 8

Module:1 Logical Reasoning **8 hours** **SLO:6**

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmetic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2 Quantitative Aptitude **12 hours** **SLO:7**

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

NumB.E.r System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3 Verbal Ability **10hours** **SLO:8**

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: 30hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

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SYLLABUS

SEMESTER III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA3102	FOURIER ANALYSIS AND TRANSFORMS *(EEE, ECE, E&I, AGRI, BIO MEDICAL & FOOD TECHNOLOGY)*	3	1	0	4

Course Objectives

1. Analyze Fourier series which is central to many applications in engineering.
2. Apply the effective tools for the solutions of one dimensional boundary value problems.
3. Apply the effective tools for the solutions of two dimensional heat equations.
4. Apply Fourier transform techniques in various situations.
5. Analyze Z transform techniques for discrete time systems.

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.	12
II	**BOUNDARY VALUE PROBLEMS** Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	**TWO DIMENSIONAL HEAT EQUATIONS** Steady state solution of two dimensional equation of heat conduction in infinite plate and semicircular plate.	12
IV	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity(Statement only).	12
V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS** Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem (excluding proof)– Solution of difference equations using Z – transform.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
CO2: Employ Fourier series in solving the boundary value problems.
CO3: Understand Fourier series in solving the two dimensional heat equations.
CO4: Apply Fourier transform techniques which extend its applications.
CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

TEXT BOOKS:

T1 Veerarajan. T, "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012

T2 Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt. Ltd, 2007

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, 2196

R3 Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi,2018

R4 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EE3201	ELECTRONIC DEVICES AND CIRCUITS (*COMMON TO EIE AND EEE*)	3	1	0	4

Course Objectives

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, Ideal diode, Diode Current Equation, Application of Diode - Rectifiers: Half Wave and Full Wave Rectifier, with capacitive filters, Display devices – LED, laser diodes, Zener Diode: Characteristics, Zener as Regulator	12
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.	12
III	**DESIGN AND ANALYSIS OF SMALL SIGNAL AMPLIFIER** BJT - Transistor Modeling, Hybrid Equivalent Circuit, Small Signal Analysis - Low Frequency Model: CE, CB, CC amplifiers, Darlington connections, Differential Amplifier - A.C and D.C Analysis, Single Tuned Amplifiers.	12
IV	**LARGE SIGNAL AMPLIFIERS** Classification of Power Amplifiers, Efficiency of Class A Amplifier, Class B Complementary – Symmetry and Class C - operation, Push - Pull Power Amplifiers- Calculation of Power Output, Efficiency and Power Dissipation - Crossover Distortion.	12
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.	12
	Total Instructional Hours	**60**

Course Outcomes

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

TEXT BOOKS:

T1 David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall Publications, 2008.
T2 S.Salivahanan, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw-Hill Education, 2012.

REFERENCE BOOKS:

R1 Rashid, "Microelectronic Circuits: Analysis & Design" 2nd Edition , CL Engineering publishers, 2010
R2 A P Godse, U A Bakshi, "Electronic Devices and Circuits", Technical Publications, 2017.
R3 Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE3202	ELECTRICAL MACHINES I	3	0	0	3

Course Objectives

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 - Equivalent circuit parameters - Losses and Efficiency - Tests: Open circuit and Short circuit –Sumpner's test – Condition for maximum efficiency and 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 Co-energy - 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 – Principles of Armature reaction and commutation - Methods of improving commutation- Characteristics of DC Generators - Applications.	9
V	**D.C MOTORS** Principle and Working of D.C Motors - Types of DC Motors - Back emf - Equations – Voltage , Power, Speed and Torque - Efficiency - D.C Motor characteristics – Applications. Speed control of DC motors - Necessity of starters - three point and four point starter – Testing of D.C Machines - Swinburne's test and Brake test.	9
	Total Instructional Hours	**45**

Course Outcomes

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 2195.

R3 Ashfaq Hussain, 'Electrical Machines' Second Edition, Macmillian International Edition, 2016.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EE3203	FIELD THEORY	3	0	0	3

Course Objectives

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 – 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	9
II	**ELECTROSTATICS – II** Potential due to point charge –Electric Field Intensity- Electric field and equipotential points, Uniform and Non-Uniform field– 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, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization,– Boundary conditions, scalar and vector potential, 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, conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedance and skin depth - Poynting Theorem	9
	Total Instructional Hours	**45**

Course Outcomes

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, McGraw Hill International Edition,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE3251	ELECTRICAL AND ELECTRONIC MEASUREMENTS *(COMMON TO EIE AND EEE)*	2	0	2	3

Course Objectives

1. Understand the Basics of Electrical Measuring Instruments.
2. Examine the Various Bridges used for Measuring Electrical Parameters.
3. Describe the Analog and Digital Electronic Instruments and it's Working
4. Illustrate the function of Cathode Ray oscilloscope and Signal Generators.
5. Outline Smart Instrumentation and Display Devices.

Unit	Description	Instructional Hours
I	**MEASUREMENT SYSTEM AND MEASURING INSTRUMENTS** Generalized Measurement system, Classification of instruments, Error in measurement, Classification of errors. Principle, Construction, Operation of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters - Single phase Watt meters and Energy Meters - D.C & A.C Potentiometers - Instrument Transformers- Instruments for Measurement of Frequency and Phase- **Calibration of watt meter.**	6+3
II	**MEASUREMENT OF R,L,C USING BRIDGES** D.C Bridges: Wheatstone - Kelvin double bridge- Megger – A.C Bridges: Anderson Bridge –Maxwell Bridge- Hay's Bridge and Schering bridge - **Measurement of Unknown Capacitance using Schering Bridge.**	6+3
III	**ELECTRONIC INSTRUMENTS** Analog Meters: D.C Ammeter and Voltmeters - Multimeter - Q meter - True RMS Meter - Vector Impedance Meter - RF Voltage and Power Measurements - Instrumentation Amplifier. Digital Meters: Digital Tachometer – DMM-ADC: Successive Approximation, Dual Slope –DAC: Weighted Resistor, R-2R Ladder type- Digital Frequency Counters - LCR meter- **Calibration of DC Ammeter and DC Voltmeter.**	6+3
IV	**DIGITAL STORAGE OSCILLOSCOPE AND SIGNAL GENERATORS** Analog Storage Oscilloscope - Sampling Oscilloscopes - Digital Storage Oscilloscopes - Sine Wave Generator - Sweep Frequency Generator, Pulse and Square Wave Generator - Wave Analyzer: Harmonic Distortion Analyzer - Spectrum Analyzer- **Measurement of frequency and voltage at different ac inputs using DSO.**	6+3
V	**SMART INSTRUMENTS AND RECORDERS** Serial, Parallel ports, USB–IEEE 488- Applications of Digital Instruments- Elements of Data Acquisition - Smart Sensor. **Acquiring and Generating Signals using DAQ Card.** Recording Devices: X-Y Plotters, Magnetic Tape Recording - Data Loggers- Display Devices: LED, LCD.	6+3
	Total Instructional Hours	**30+15**

Course Outcome

CO1: Definition of errors, error analysis and characteristics response of different order transducers.
CO2: In-depth knowledge about resistive transducers.
CO3: Outline an adequate knowledge about various inductive transducers.
CO4: Make use of capacitive transducers on industrial parameters measurement.
CO5: Summarize the role of different industrial transducers and sensors.

TEXT BOOKS:

T1 - Sawhney. A.K, "A Course in Electrical and Electronics – Measurement and Instrumentation", 21th Edition, Dhanpat Rai & Sons, 2014.
T2 - Albert D. Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2008.

REFERENCE BOOKS:

R1 - J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, 2003.
R2 - Kalsi.H.S, "Electronic Instrumentation", Tata McGraw Hill, 2010.
R3 - Doebelin. E, "Measurement Systems: Application and Design", 6th Edition, Tata McGraw Hill Private Limited, 2012.
R4 - David A Bell, "Electronic Instrumentation and Measurements", Oxford Pubilisher, Second Edition, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE3001	ELECTRONIC DEVICES AND CIRCUITS LABORATORY (*COMMON TO EIE AND EEE*)	0	0	3	1.5

Course Objectives

1.Apply the knowledge gained in designing basic electronic circuits
2.Develop feedback amplifiers and oscillators
3. Construct and test the power supply circuits.

Expt. No.	Description of the Experiments
1.	Characteristics of a. Semi conductor diode b. Zener diode
2.	Characteristics of a NPN Transistor under a. Common Emitter Configuration b. Common Collector Configuration c. Common Base Configurations
3.	Characteristics of JFET & SCR
4.	Characteristics of UJT
5.	Implementation of Relaxation Oscillator
6.	Frequency response characteristics of a Common Emitter amplifier
7.	Construct and analyze the Current series Feedback Amplifier.
8.	Develop and testing of transistor RC phase shift oscillator
9.	Characteristics of photo diode and photo transistor
10.	Construct and testing of Single Phase half-wave rectifier
11.	Construct and testing Single Phase full wave rectifier
	Total Practical Hours **45**

Course Outcomes

CO1 Understand the characteristics of semiconductor devices
CO2 Develop various electronic circuit configurations.
CO3 Demonstrate the frequency response of amplifiers.
CO4 Examine the current series feedback amplifier and RC phase shift oscillator.
CO5 Construct and testing the of rectifier circuits.

REFERENCES:

R1. Poornachandra Rao S. and Sasikala B., —Handbook of experiments in Electronics and Communication Engineeringl, Vikas Publishing House Pvt. Ltd., New Delhi, 2007.
R2. Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE3002	ELECTRICAL MACHINES LABORATORY	0	0	3	1.5

Course Objectives

1 Expose the students to operate DC machines.
2 Explore the operation and speed control of DC motor.
3 Interpret the operation and performance of single phase transformer.

EXPT.NO	Description of the Experiments
1.	Open circuit and load characteristics of DC shunt generator- critical resistance.
2.	Open circuit and load characteristics of DC compound generator
3.	Load test on DC shunt motor.
4.	Load test on DC series motor.
5.	Speed control of DC shunt motor.
6.	Swinburne's test.
7.	Load test on single phase transformer
8.	Open circuit and short circuit tests on single phase transformers.
9.	Sumpner's test on single phase transformer.
10.	Separation of no load losses in single phase transformer.
11.	Study of DC motor starters and three phase transformers connections.
	Total Practical Hours **45**

Course Outcomes

CO1 Ability to operate the DC generators and motors.
CO2 Ability to choose the type of DC machine for specific applications.
CO3 Determine the performance characteristics of DC motor by conducting direct and indirect tests.
CO4 Ability to model the transformer and their application to power system.
CO5 Determine the performance characteristics of DC shunt and Compound generator by conducting load tests.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MC3191	INDIAN CONSTITUTION	2	0	0	0

Course Objective

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self reflection.
4. Development of commitment and courage to act.

Unit	Description	Instructional Hours
I	**BASIC FEATURES AND FUNDAMENTAL PRINCIPLES** Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
II	**FUNDAMENTAL RIGHTS** Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
III	**PARLIAMENTARY FORM OF GOVERNMENT** The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.	4
IV	**LOCAL GOVERNANCE** Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article21 – scope of the right to life and personal liberty under article 21.	4
V	**INDIAN SOCIETY** Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
	Total Instructional Hours	**20**

Course Outcome

CO1: Understand the functions of the Indian government
CO2: Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

T1- Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 2197.
T2- R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi.2197.
T3-Maciver and Page, " Society: An Introduction Analysis", Laxmi Publications,2007.
T4-K.L Sharma, "Social Stratification in India: Issues and Themes",SAGE Publications Pvt. Ltd, 2197.

REFERENCE BOOKS:

R1-Sharma, Brij Kishore, " Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2017.
R2-U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar,2198.
R3-R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.2182.

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SEMESTER IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MA4101	NUMERICAL METHODS (COMMON TO AERO, AUTO,MECH,MCTS,EEE & EIE)	3	1	0	4

Course Objectives

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Analyze various methods to find the intermediate values for the given data.
3. Explain concepts of numerical differentiation and numerical integration of the unknown functions.
4. Explain single and multi-step methods to solve Ordinary differential equations

Describe various methods to solve ordinary differential equations and partial differential equations.

Unit	Description	Instructional Hours
I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS** Solution of Algebraic and Transcendental equations: Newton Raphson method . Solution of linear system: Gauss Elilmination - Gauss Jordan method -Gauss seidel method. Matrix inversion by Gauss Jordan method.	12
II	**INTERPOLATION** Interpolation - Newton's forward and backward difference formulae – Newton's divided difference formula and Lagrangian interpolation for unequal intervals.	12
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Numerical Differentiation: Newton's forward and backward interpolation formulae for equal intervals – Newton's divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson's 1/3 rule - Double integration using Trapezoidal and Simpson's rules.	12
IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods for solving first order equations: Taylor's series method – Euler and Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne's predictor and corrector method.	12
V	**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** Solution of second order ordinary differential equation by Finite difference method – Solution of partial differential equation: one dimensional heat equation by Bender schmidt method – One dimensional Wave equation by Explicit method– Poisson Equations by Finite difference method.	12
	Total Instructional Hours	**60**

Course Outcomes

CO1: Solve the system of linear algebraic equations which extends its applications in the field of engineering
CO2: Apply various methods to find the intermediate values for the given data.
CO3: Identify various methods to perfrom numerical differentiation and l integration
CO4: Classify and solve ordinary differential equations by using single and multi step methods.
CO5: Illustrate various methods to find the solution of ordinary and partial differential equations.

TEXT BOOKS:

T1 - Erwin Kreyszig,"Advanced Engineering Mathematics",10th Edition,Wiley India Private Ltd., New Delhi, 2018.
T2 - Kreyszig.E."Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons (Asia) limited,2017

REFERENCE BOOKS :

R1 - M.K.Jain,S.R.K.Iyengar, R.K.Jain "Numerical methods for Scientific and Engineering Computation", Fifth Edition, New Age International publishers 2010.
R2- Grewal B.S. and Grewal J.S. "Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2015.
R3 - S.K.Gupta, Numerical Methods for Engineers", New Age International Pvt.Ltd Publishers, 2015.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EE4201	ELECTRICAL MACHINES II	3	1	0	4

Course Objectives

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 - Induction generator - problems - Applications.	12
II	**STARTING, BRAKING 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 - Braking: Plugging, dynamic braking and regenerative braking - Speed control techniques - Voltage control - Pole changing - Frequency control - Rotor resistance control – Static 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 - 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 Outcomes

- 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 J.Gnanavadivel, Dr.C.Senthil Kumar, Dr.P.Maruthapandi, "Electrical Machines II" Anuradha Publications, 2017

REFERENCE BOOKS:

R1 P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

R2 K. Murugesh Kumar, 'Induction and Synchronous Machines', Vikas Publishing House Pvt. Ltd, 2009.

R3 Fitzgerald Kingsley and Umans, "Electric Machinery" 6th Edition, McGraw Hill Books co., New Delhi, 2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE4202	INTEGRATED CIRCUITS AND ITS APPLICATIONS *(COMMON TO EEE AND EIE)*	3	0	0	3

Course Objectives

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. Summarize internal functional blocks of special function IC's.

Unit	Description	Instructional Hours
I	**IC FABRICATION** Introduction - IC classification - chip size and circuit complexity - fundamental of monolithic IC technology - Silicon wafer preparation - Epitaxial growth – Oxidation - Photolithography - diffusion - Ion Implantation-Isolation Techniques-Metallization-Assembly Processing and packaging - Fabrication FET and CMOS	9
II	**CHARACTERISTICS OF OP-AMP** Basic information of OP-AMP – The Ideal OP-AMP characteristics - DC characteristics - AC characteristics - frequency response of OP-AMP - Slew Rate- Inverting and Non-inverting Amplifiers -Voltage Follower-Differential amplifier - Basic OP-AMP applications: Summer - Differentiator and Integrator - V/I & I/V converters- S/H circuit.	9
III	**APPLICATIONS OF OP-AMP** Instrumentation amplifier - First order LPF - First order HPF - First order BPF and Band reject filters - Comparators - Multivibrators – Triangular wave generator – clippers – clampers - peak detector- - D/A converter : R- 2R ladder and weighted resistor types - A/D converters : Successive Approximations- Duel Slope.	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 - 723 General purpose regulator - switching regulator - Opto Coupler IC's- IC8038 function generator.	9
	Total Instructional Hours	**45**

Course Outcomes

- 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 , Shail B. Jain, "Linear Integrated Circuits", 5th Edition, New Age Publishers,2018.
T2 - S Salivahanan, V S Kanchana Bhaaskaran, " Linear Integrated Circuits", 2nd Edition, TMH,2017.

REFERENCE BOOKS:

R1- Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", IV edition, Pearson Education, 2015.
R2- Robert F.Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2000.
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.	19EE4203	DIGITAL SIGNAL PROCESSING	3	0	0	3

Course Objectives

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-	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 LTI systems - 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.	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.	19EE4251	DIGITAL LOGIC CIRCUITS (COMMON TO EIE AND EEE)	2	1	2	4

Course Objectives

1. To understand different methods used for the simplification of Boolean functions
2. To study combinational circuits
3. To learn synchronous sequential circuits.
4. To infer the concepts of asynchronous sequential circuits and Programmable Logic Devices
5. To Interpret the fundamentals of HDL.

Unit	Description	Instructional Hours
I	**MINIMIZATION TECHINIQUES AND LOGIC GATES** Boolean algebra and laws – Demorgan's Theorem—Minimization of Boolean Expressions. Minterm - Maxterm- Sum of Product (SOP) – Product of Sum(POS) - Karnaugh map minimization - Don't care conditions. Simplification of Boolean expressions using logic gates : NAND and NOR - **Implementation of Boolean Functions using K-map.**	9+3
II	**COMBINATIONAL CIRCUITS** Analysis and design of combinational circuits- Adders, Subtractors, Multiplier, -Code converters – Magnitude comparator – Decoder and Encoder- Multiplexer and De-multiplexer - **Experiment Analysis of Adder and Subtractor circuits.**	9+3
III	**SYNCHRONOUS SEQUENTIAL CIRCUITS** Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering. Asynchronous and Synchronous type - counters –Modulo counters, Shift registers. Design of synchronous sequential circuits – Moore and Melay models- state diagram-state reduction- state assignment. **Implementation of Code converters: Excess-3 to BCD and vice-versa.**	9+3
IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES** Analysis of Asynchronous sequential logic circuits - Transition table, flow table - race conditions, hazards and errors in digital circuits. Introduction to Programmable Logic Devices: PROM – PLA –PAL - **Experimental analysis of race conditions in digital circuits.**	9+3
V	**HDL** Introduction to Hardware Description Language. HDL for combinational circuits: Adders - Subtractors – Decoder and Encoder- Multiplexer and De-multiplexer. HDL for Sequential Circuits: flip-flops – counters- Registers - **Implementation of Multiplexer and De-multiplexer.**	9+3
	Total Instructional Hours	**60**

Course Outcomes

CO1: Apply the knowledge acquired about Boolean functions.
CO2: Summarize the concepts of combinational circuits.
CO3: Transform the acquired skill in designing the synchronous sequential circuits.
CO4: Ability to understand and analyze the asynchronous sequential circuits.
CO5: Outline the concepts of HDL.

TEXT BOOKS:

T1 - Raj Kamal, 'Digital systems-Principles and Design', Pearson Education 1st Edition, 2012.
T2 - M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.

REFERENCE BOOKS:

R1-Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
R2-Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
R3-Charles H.Roth, Jr,LizyLizy Kurian John, 'Digital System Design using VHDL, Cengage,2013.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE4001	ELECTRICAL MACHINES LABORATORY II	0	0	3	1.5

Course Objectives

1 Determine the losses and performance characteristics of single phase and three phase Induction Motor using proper tests.
2 Study the operation and speed control of AC Machines and Starters.
3 Determine the regulation of synchronous machines using various methods.

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.	Speed control of three phase Slip ring Induction Motor.
4.	Determination of performance parameters of induction motor using Circle diagram.
5.	Load test on single-phase induction motor.
6.	No load and blocked rotor test on single-phase induction motor.
7.	Regulation of three phase alternator by pessimistic and optimistic method.
8.	Regulation of three phase alternator by ZPF or Potier triangle method.
9.	Determination of X_d an X_q for three phase salient pole alternator by slip test.
10.	V and Inverted V curves of Three Phase Synchronous Motor.
11.	Study of Induction motor starters (DOL, Automatic Star/Delta & 3 Phase Autotransformer)

Total Practical Hours

Course Outcomes

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 determine the internal parameters of three phase induction motor through an equivalent circuit.
CO5 Analyze and calculate the losses of three phase induction motor.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EE4002	INTEGRATED CIRCUITS LABORATORY *(COMMON TO EEE AND EIE)*	0	0	3	1.5

Course Objective

1. Understand the performance characteristics of Op-amp.
2. Implement of Op-amp applications.
3. Construct and test waveform generation circuits.

S.No	Description of the Experiments
1.	Performance characteristics of Op-Amp IC.
2.	Implementation of inverting and non-inverting amplifiers using Op-Amp.
3.	Construct and testing of Adder and Subtractor using Op-Amp.
4.	Implementation of differential amplifier and voltage follower using Op-Amp.
5.	Implementation of Integrator and Differentiator using Op-Amp.
6.	Frequency response characteristics of first order low pass and high pass filters.
7.	Construct and testing of D/A and A/D Converter.
8.	Construct and testing Astable and Monostable multivibrator using IC 555 timer.
9.	Implementation of Schmitt Trigger.
10	Construct and testing of Regulated DC power supply using IC 723.
11.	Study of VCO and PLL ICs.

Total Practical Hours 45

Course Outcome

CO1: Understand the performance characteristics of Op-amp.
CO2: Implementation of various applications of Op-amp.
CO3: Understand the performance of filters and converters.
CO4: Construct multivibrator and regulated power supply circuits using IC
CO4: Assimilate the knowledge on VCO and PLL ICS.

REFERENCES:

R1- Ramakant A. Gayakwad, "Lab manual for Op-amps and Linear Integrated Circuits", Prentice Hall, 2010.
R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE/ VALUE EDUCATION	2	0	0	0

Course Objective

1. The course aims at imparting basic principles of thought process, reasoning and inferencing.
2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions,Indian linguistic tradition and Indian artistic tradition.

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics),Indian artistic tradition and Case Studies.	4
	Total Instructional Hours	**20**

Course Outcome

CO1: Ability to understand the structure of Indian system of life.
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

R1 -V.Sivaramakrishna (Ed.), "Cultural Heritage of India-Course Material", Bharatiya Vidya Bhavan,Mumbai, 5th Edition, 2014.
R2 - Swami Jitatmananda, "Modern physics and Vedanta", Bharatiya Vidya Bhavan,2186.
R3 - Fritjof Capra, The Tao of Physics
R4- Fritjof Capra, The wave of Life.
R5- V N Jha, Tarkasangraha of Annambhatta, Inernational Chinmaya Foundation, Velliyanad,Ernakulam.
R6- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
R7- GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
R8- RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi,2016.
R9- P R Sharma (English translation), Shodashang Hridayam.

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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 Kamuvisa 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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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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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(both120 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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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE6203	PROTECTION AND SWITCHGEAR	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, SF6 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

1. Impart knowledge to the students on various electrical and electronic control circuits.
2. Design and fabrication for Motors and UPS.
3. Obtain knowledge on thermal or electromagnetic relay.

S.No	Description of the Experiments
1.	Design and implementation of control circuits for DOL starter and star/delta starter withThermal Over Load Relay.
2.	Design and implementation of speed control circuit for domestic fan using solid state switching devices.
3.	Design and implementation control circuits for plugging/reversal operation for DC and ACMotor.
4.	Design and testing of linear mode power supply (fixed or variable).
5.	Design and testing of MOSFET driver circuit.
6.	Design 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 protectionsystems 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:

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.

REFERENCE 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:

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,

REFERENCE 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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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
	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	
I	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
	ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS	
II	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
	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	
III	Generation of High voltages / currents - DC, AC, impulse voltages and currents.Tripping and control of impulse generators.	9
	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	
IV	Measurement of High DC, AC, impulse voltages and currents – cathode ray oscillographs for Impulse voltages and current measurements.	9
	HIGH VOLTAGE TESTING & INSULATION COORDINATION	
V	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:

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

REFERENCE 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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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:

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.

REFERENCE 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.

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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 PLCProgramming – 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) -MasterTerminal 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 – WaterPurification 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 and Automation (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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SYLLABUS

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7201	SOLID STATE DRIVES	3	0	0	3

Course Objective

1. Understand steady state operation and transient dynamics of a motor load system.
2. Analyze and design the speed controllers for a closed loop solid state DC motor drives.
3. Recall and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
4. Study and understand the operation and performance of AC motor drives.
5. Design the speed controllers for induction motor control

Unit	Description	Instructional Hours
I	**DRIVE CHARACTERISTICS** Electric drives and advantages – Equations governing motor load dynamics – steady state stability – multi quadrant operation – modes of operation: steady state, acceleration, deceleration, starting & stopping – Components and classification of load torques – choice of electrical drives.	9
II	**DC MOTOR DRIVES** Transient analysis: Armature control and field control – Ward Leonard Drives – Single phase half and fully controlled rectifier control of separately excited DC motor – chopper control of separately excited DC motor-Closed loop speed control for DC motors.	9
III	**INDUCTION MOTOR DRIVES** Stator voltage control–variable frequency control –Cycloconverter control of induction motor - voltage and current fed inverter control– closed loop speed control – static rotor resistance control-v/f and slip power recovery scheme	9
IV	**SYNCHRONOUS MOTOR DRIVES** Variable frequency control and self control of synchronous motor variable speed constant frequency generation – CSI fed synchronous motor drive with forced commutation – permanent magnet synchronous motor.	9
V	**DESIGN OF CONTROLLERS FOR DRIVES** Design of controllers for linearly and exponential varying inputs – phase margin optimum control – magnitude optimum control – symmetrical optimum control – Application of P, I, D, PI, PD, and PID controller to drive. CASE STUDY: "Application of PI and PID controllers in Electric Vehicle."	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Analyze the stability of the system depending on load.
CO2:Identify the type of electric motor applicable for various applications.
CO3:Analyze the operation of the converter and chopper fed dc drive.
CO4:Design the speed controllers for a closed loop solid state DC motor drives.
CO5:Design the speed controllers for induction motors to control and maintain the speed.

TEXT BOOKS:

T1 GopalK.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
T2 VedamSubramanyam, "Electric Drives concepts and applications", Tata McGraw Hill, 2007.

REFERENCE BOOKS:

R1 S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
R2 BimalK.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
R3 R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice Hall of India, 2001.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7202	ELECTRICAL ENERGY UTILIZATION AND CONSERVATION	3	0	0	3

Course Objective

1. Understand the operating principle of different power generation types.
2. Study the different methods of electric heating and electric welding.
3. Recognize the basic principles of illumination and different types of lightning system.
4. Describe the basic principle of electric traction.
5. Enumerate the concepts of non conventional energy resources.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Review of conventional methods - Thermal, Hydro and Nuclear based power generation. Nonconventional methods of power generation - Tidal Power - Geothermal - Magneto Hydro Dynamic (MHD).	9
II	**INDUSTRIAL HEATING AND WELDING** Role of electric heating for industrial applications - Resistance heating - Induction heating - Dielectric heating - Electric Arc Furnaces - Electric welding - Electric Arc Welding.	9
III	**ILLUMINATION** Introduction - Terms used in illumination –Laws of illumination - Lumen or flux methods of calculation - Electric Lamp - Tungsten lamps and fluorescent lamps –Basic principles of light control-Street lighting and Flood lighting – Design of Choke and Capacitor.	9
IV	**ELECTRIC TRACTION** Merits of electric traction - Requirements of electric traction system - Supply systems – Mechanics of train movement - Traction motors - DC motor - AC motor – Braking – Recent trends in electric traction	9
V	**NON CONVENTIONAL ENERGY RESOURCES** Introduction – basic components of a WECS (Wind Energy Conservation System)- Classification of WECS - Flat plate collectors- Concentrating collector – Parabolic trough Reflector –Mirror Strip Reflector–Advantages and Disadvantages of Concentrating collectors over Flat plate Collector.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze the various power generation methods both conventional and non conventional.
CO2: Valuate the most appropriate heating or welding techniques for suitable applications.
CO3: Assess the various level of illuminosity produced by different illuminating sources.
CO4: Formulate the different types of traction motors and braking .
CO5: Handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOKS:

T1 C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003

T2 Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

REFERENCE BOOKS:

R1 E. Openshaw Taylor, "Utilization of Electric Energy", OrientLongman.

R2 B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (P) Ltd, New Delhi, 2003.

R3 J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K. Kataria and Sons, 2002.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7203	POWER SYSTEM OPERATION AND CONTROL	3	0	0	3

Course Objective

1. Overview of power system operation and control.
2. Model power-frequency dynamics and to design power-frequency controller.
3. Model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4. Study the economic operation of power system.
5. Teach about SCADA and its application for real time operation and control of power systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION** An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve – Straight line and exponential curve fitting technique – demand factor - diversity factor – Load forecasting	9
II	**REAL POWER - FREQUENCY CONTROL** Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system – Modelling- response - two-area system – modeling - tie line Response	9
III	**REACTIVE POWER–VOLTAGE CONTROL** Generation and absorption of reactive power-excitation systems-modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, SVC (TCR + TSC) and STATCOM.	9
IV	**ECONOMIC LOAD DISPATCH AND UNIT COMMITMENT** Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - co-ordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method - forward dynamic programming.	9
V	**COMPUTER CONTROL OF POWER SYSTEMS** Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - state transition diagram showing various state transitions and control strategies.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret the overview of power system operations.
CO2: Analysis the single area and multi-area system using frequency control
CO3: Summarize the various voltage control methods of power system
CO4: Solve the economic load dispatch, optimum unit commitment for a power system
CO5: Illustrate the functional content of SCADA, EMS and related systems

TEXT BOOKS:

T1 Olle.I.Elgerd, 'Electric Energy Systems Theory An Introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010

T2 Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc.,2003.

REFERENCE BOOKS:

R1 V. K. Mehta and R. Mehta, Principles of Power Systems, S. Chand Publishing, New Delhi 4th edition,2009.

R2 Nagrath I.J. and Kothari D.P., Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.

R3 Kundur P.,Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7001	DRIVES AND CONTROL LABORATORY	0	0	4	2

Course Objective

1. Acquire software development skills and experience in the usage of standard packages.
2. Apply the knowledge in designing of FPGA controller for Induction Motor.
3. Construct a speed controller using DSP for electrical motor.

S.No	Description of the Experiments
1	Simulation of Single phase and Three phase fully controlled converter using R and RL load using MATLAB / SIMULINK
2	Simulation of closed loop control of converter fed DC motor using MATLAB / SIMULINK
3	Simulation of closed loop control of chopper fed DC motor using MATLAB / SIMULINK
4	Simulation of VSI fed 3 Phase induction motor using MATLAB / SIMULINK
5	DSP based closed loop drive for induction motor drive.
6	Speed control using FPGA for Induction motor drive.
7	DSP based chopper fed DC motor drive.
8	Speed control of Brush Less DC motor drive.
9	PLC based AC/DC Motor drives.
10	Study of Power converters for Switched Reluctance Motor Drive.
	Total Instructional Hours **45**

Course Outcome

CO1: Develop a power electronic circuit using simulation software's.
CO2: Simulates a closed loop control of converter fed electrical drives.
CO3: Identify a suitable power electronic converter for ax and dc motor.
CO4: Evaluate the speed controlling techniques for BLDC motor using DSP.
CO5: Examine the configuration of PLC drives for ac motor.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7701	TECHNICAL SEMINAR	0	0	4	2

Course Objective

1. Prepare electrical and electronics engineering developments and prepare and present on technical topics.
2. Usage of various teaching aids such as over head projectors, power point presentation and demonstrative models.

Description

During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present the seminar.

Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report.

Three member departmental committee headed by Head of the Department will evaluate the student attendance, presentation, report and conduct viva-voce examination to award marks appropriately. Evaluation is 100% internal mode.

Total Instructional Hours 30

Course Outcome	At the end of this course students will be able to
C01	Prepare and present a topic on engineering subjects.
C02	Prepare and present general topics effectively with good communication skills.
C03	Categorize the available teaching aids and use them in their presentations.
C04	Discuss their ideas with confidence.
C05	Transfer their technical or general knowledge to others with confidence.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE7702	INDUSTRIAL TRAINING / INTERNSHIP	0	0	0	1

Course Objectives

1. Apply the knowledge and skills which they have acquired on campus in a real-life work situation.
2. Create opportunities for practical, hands-on learning from practitioners in the students' field of study
3. Establish an exposure for the students to the work environment, common practices, employment opportunities and work ethics in the relevant field.

The student shall undergo Internship / Industrial Training and the credits earned will be indicated in the grade sheet. The student is allowed to undergo Internship / Industrial Training during the entire period of study. The Internship / Industrial Training shall carry 100 marks and shall be evaluated at end semester examination.

The review committee may be constituted by the Head of the Department at the end of Industrial Training / Internship, the student shall submit a report on the training undergone and a certificate from the organization concerned.

The evaluation will be made based on this report and a viva-voce examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department.

Course Outcomes

CO1: Improve the skills to communicate efficiently and gain management skills related to industry / research organizations.
CO2: Extend the boundaries of knowledge through research and development.
CO3: Discriminate the knowledge and skills acquired at the workplace to their on-campus studies.
CO4: Develop greater clarity about academic and career goals.
CO5: Visualize the impact of engineering solutions to the society.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE8901	PROJECT WORK	0	0	20	10

Course Objectives

1. Analyse a methodology to select a good project and able to work in a team.
2. Transform the ideas behind the project into a product.
3. Validate the technical report.

A project must be selected either from research literature published list or the students themselves may propose suitable topics in consultation with their guides.

The aim of the project work is to strengthen the comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee shall be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Controller of Examination based on oral presentation and the project report.

Course Outcome

CO1: Implement the skills acquired in the previous semesters to solve complex engineering problems.
CO2: Develop a model / prototype of an idea related to the field of specialization.
CO3: Establish the work individually or in a team to identify, troubleshoot and build products for environmental and societal issues.
CO4: Effective presentation of ideas with clarity.
CO5: Evaluate surveys towards developing a product which helps in life time learning.

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PROFESSIONAL ELECTIVE-III

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7301	MICROCONTROLLER BASED SYSTEM DESIGN	3	0	0	3

Course Objective

1. Explain the hardware architecture of the PIC microcontroller.
2. Extensive hands-on the PIC interrupts and timers.
3. Design and interfacing of microcontroller-based embedded systems.
4. Embedded system for ARM programming model will be introduced.
5. High-level languages are used to interface the Embedded ARM to various applications

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
I	**INTRODUCTION TO PIC MICROCONTROLLER** Introduction to PIC Microcontroller – PIC 16C6x and PIC16C7x Architecture – PIC16cxx — Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.	9
II	**INTERRUPTS AND TIMER** PIC micro controller Interrupts - External Interrupts-Interrupt Programming – Loop time subroutine –Timers - Timer Programming – Front panel I/O-Soft Keys– State machines and key switches – Display of Constant and Variable strings.	9
III	**PERIPHERALS AND INTERFACING** I2C Bus for Peripherals Chip Access – Bus operation-Bus subroutines – Serial EEPROM — Analog to Digital Converter – UART - Baud rate selection – Data handling circuit – Initialization - LCD and keyboard Interfacing – ADC – DAC - and Sensor Interfacing.	9
IV	**INTRODUCTION TO ARM PROCESSOR** ARM Architecture – ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples – Architectural Support for Operating systems.	9
V	**ARM ORGANIZATION** 3-Stage Pipeline ARM Organization – 5 Stage Pipeline ARM Organization – ARM Instruction Execution - ARM Implementation– ARM Instruction Set – ARM coprocessor interface – Architectural support for High Level Languages – Embedded ARM Applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Experience of working at the architecture of the PIC microcontrollers
CO2: Identify factors moving the data transfer and interrupts and timer in PIC microcontroller.CO3: Programme the controller for typical industrial Electronics application
CO4: write ARM Assembly Language program.
CO5: Embed the code in ARM processor for stand-alone system for embedded system designs.

TEXT BOOKS:

T1 Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.
T2 Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE BOOKS:

R1 Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.
R2 Ajay V.Deshmukh' Microcontroller"[Theory and application].
R3 Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7302	MICRO ELECTRO MECHANICAL SYSTEMS	3	0	0	3

Course Objective

1.Apply knowledge of semiconductors and solid mechanics to fabricate MEMS devices
2. Analyze on the rudiments of Micro fabrication techniques
3.Differentiate various sensors and actuators
4. Categorize different materials used for EMS
5. Interpret the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Intrinsic Characteristics of MEMS – Energy Domains and Transducers–Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis.	9
II	**MICRO SENSORS AND ACTUATORS** Micro sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor –Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micro magnetic components	9
III	**PIEZO ELECTRIC SENSORS AND ACTUATORS** Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators –piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.	9
IV	**MICROMACHINING AND MANUFACTURING** Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Case studies -Basic surface micro machining processes – LIGA Process - SLIGA-Micro system packaging-materials-Die level-device level-system level-packaging Techniques-die preparation-surface bonding-wire bonding-sealing.	9
V	**MICRO SYSTEM DESIGN** Design considerations-Process Design-Mask layout Design- Mechanical Design-Applications Of Micro Systems In Automotive Industry, Bio-Medical, Aerospace and Telecommunications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Study and identify the types of semiconductors used in MEMS.
CO2: Analyze the Micro fabrication techniques.
CO3: Generalize the different Types Of Sensors And Actuators.
CO4: Design the different Materials used for MEMS.
CO5: Develop different components related to MEMS and apply in various Engineering disciplines.

TEXT BOOKS:

T1 Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
T2 Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill.

REFERENCE BOOKS:

R1 Nitaigour premchand Mahalik,"MEMS",Tata MCgrawhill publication 2008.
R2 P.Rai choudhury,"MEMS and MOEMS technology and applications",PHI learning pvt ltd,2012.
R3 Tephen D Senturia, 'Microsystem Design', Springer Publication, 2000.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7303	SOLAR PHOTOVOLTAIC FUNDAMENTALS & APPLICATIONS	3	0	0	3

Course Objective

1. Study the basic principles of solar energy - radiation and its measurements.
2. Describe the different methods of solar tracking system.
3. Compute the solar PV modules with solar cell technologies.
4. Customize the balance of solar PV system
5. Expose various applications of solar Photovoltaic system.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Sun's Energy Advantages-Energy conversion challenges- Solar Constant-Solar Radiation at the Earth's Surface-Solar Radiation-Geometry- Altitude angle-Zenith angle-Solar Azimuth angle-Surface Azimuth angle-Day Length-Local Solar Time(LST).Local Apparent Time (LAT)-Sunrise, Sunset and Day length.	9
II	**SOLAR RADIATION MEASUREMENT and SUN TRACKING** Solar Radiation Measurements : Angstrom Compensation Pyrheliometer-Pyranometer-Estimation of Average Solar Radiation-Solar Radiation on Tilted Surfaces-.Path of sun's motion- Tracking Types-Advantages and disadvantages-One axis tracking-Two axis tracking-Azimuth tracking.	9
III	**SOLAR PV MODULES** Solar cell Technologies-Types-Wafer based Si Technologies-Thin Film: Amorphous-Crystalline Si -Solar PV Modules from solar cells-Series and parallel connection of cells-Mismatch in cell / module- Mismatch in series and parallel connection- Hot spot in the module-Bypass diode-No. of solar cells in a module-Wattage of modules-PV module power output-I-V equation-Rating of PV modules & Arrays –Efficiency of solar cells.	9
IV	**BALANCE OF SOLAR PV SYSTEMS** Introduction to batteries-Factors affecting battery performance-Batteries for PV systems-Lead-acid, Nickel-Cadmium batteries-Comparison of batteries-Importance and Types of charge controller- Necessity & types of inverter - Maximum Power Point Tracking (MPPT) System- Types (Qualitative approach only)	9
V	**APPLICATIONS OF PV SYSTEM** A Basic Photovoltaic Systems for power generation- Grid Interactive solar PV Power system-Applications of solar Photovoltaic system-Solar street lighting- home lighting system-Water pumping system-Communication equipment-Sea water desalination system-peltier cooling system.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustrate basics of solar photovoltaic systems, solar radiation and its measurements.
CO2: Characterize various solar tracking systems.
CO3: Practice the types and arrangement of PV modules.
CO4: Evaluate various level of balance of solar PV systems.
CO5: Generalize various solar photovoltaic applications.

TEXT BOOKS:

T1 Chetan Singh Solanki, 'Solar Photovoltaics Fundamentals,Technologies and Applications" -Third Edition, PHI Learning Private Limited, New Delhi, 2015

T2 B.H.Khan Non-Conventional Energy Sources", Tata McGraw-hill publishing Company, New Delhi, 2009.

REFERENCE BOOKS:

R1 - Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2013.

R2 -Rai. G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 2005.

D.P.Kothari,K.K.Singal,Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", Prentice-Hall of India Pvt. Limited, 2008

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7304	PROFESSIONAL ETHICS	3	0	0	3

Course Objective

1. Impart Knowledge To Students On Human Values /Morals /Ethics
2. Create Awareness On Engineering Ethics /Moral Issues Autonomy.
3. Make The Student Under Stand That Engineering Is Social Experimentation.
4. Develop Capability to analysis safely /responsibility rights of engineers.
5. .Expose the students to the various global issues faced by engineers working in multinational corporations.

Unit	Description	Instructional Hours
I	**HUMAN VALUES** Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment –Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management	9
II	**ENGINEERING ETHICS** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion	9
III	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics– A Balanced Outlook on Law.	9
IV	**SAFETY, RESPONSIBILITIES AND RIGHTS** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	9
V	**GLOBAL ISSUES** Multinational Corporations – Environmental Ethics – Computer Ethics –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Analyze various concepts and theories of engineering ethics.
CO2: Apply the concepts of ethics and analyze its impact on society.
CO3: Apply and analyze the concept of safety and risk in the light of engineering ethics.
CO4: Analyze and evaluate the rights and responsibility of engineers'.
CO5: Analyze the ethical issues engineers have to consider while operating globally.

TEXT BOOKS:

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

REFERENCE BOOKS:

R1 Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
R2 Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
R3 John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

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PROFESSIONAL ELECTIVE-IV

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7305	ADVANCED CONTROL THEORY	3	0	0	3

Course Objective

1. Design of Linear system
2. Analysis State space.
3. Describing function analysis.
4. Analyze the stability of the systems using different techniques.
5. Analyze the sampling process in control system

Unit	Description	Instructional Hours
I	**LINEAR SYSTEM DESIGN** Introduction to design using compensators-lag compensator-lead compensator-lag and lead compensator-PI,PD and PID controllers-feedback compensation.	9
II	**NON LINEAR SYSTEMS** Introduction to non linear system-describing function-describing function of dead zone and saturation non linearity- - describing function of relay with dead zone and hysteresis-describing function of backlash non linearity- describing function analysis of non linear system..	9
III	**SAMPLED DATA CONTROL SYSTEM** Introduction- sampling process –analysis of sampling process in frequency domain-reconstruction of sampled signals using hold circuits -discrete sequence (discrete time signal)-z transform-linear discrete time system-transfer function LDS system(pulse transform function)-analysis sampler and zero –order hold-analysis of system with impulse sampling-	9
IV	**STATE SPACE ANALYSIS** Introduction-state space formulation-state model of linear system-state diagram-state space representation using physical variables- state space representation using phase variables- state space representation using canonical variables-solution state equations-state space representation of discrete time systems.	9
V	**ANALYSIS AND DESIGN OF CONTROL SYSTEM IN STATE SPACE** Definitions involving matrices –Eigen values and Eigen vectors-similarity transformation –Cayley –Hamiltons theorem-transformations of state model-concepts of controllability and Observability.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design compensators
CO2: Analyze non-linear systems using describing function
CO3: Represent state space by different variables
CO4: Analyze stability of sampled data control system
CO5: Design and control system in state space.

TEXT BOOKS:

T1 A. Nagoorkani ' Advanced control theory ' RBA publishers ,2nd edition 1999.
T2 I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers,2003

REFERENCE BOOKS:

R1 George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.
R2 M.Gopal, 'Modern control system theory', New Age International Publishers, 2002.
R3 Ogata, Modern Control Engineering, 4th edition , Prentice Hall ,2003.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16 EE7306	INTELLIGENT CONTROL TECHNIQUES	3	0	0	3

Course Objective

1. Introduce various soft computing frames works.
2. Impart knowledge about neural networks.
3. Explain various membership function s of fuzzy logic.
4. Outline genetic algorithm and its applications.
5. Figure out hybrid soft computing techniques

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOFT COMPUTING TECHNIQUES** Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets – crisp relations and fuzzy relations: cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.	9
II	**NEURAL NETWORKS** Artificial neural net terminology, model of a neuron, Topology, Types of learning, Supervised, adaptive linear neuron, multiple adaptive linear neurons, BPN, Unsupervised Learning: Competitive learning, K-means clustering algorithm, Kohonen's feature maps. Introduction to Counter propagation Networks- CMAC Network, ART networks.	9
III	**FUZZY LOGIC** Membership functions, introduction to features of Membership functions, Methods of Membership values assignmrnts, Defuzzification methods. Fuzzy interference algorithm, fuzzy rules and approximate reasoning- mandani and TS method.	9
IV	**GENETIC ALGORITHM** Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle – stopping condition – constraints – classification genetic algorithm – multilevel optimization – real life problem- advantes and limitations of GA.	9
V	**HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS** Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Recognize the appropriate soft computing frame works
CO2: Identify and apply neural networks concepts in decision making applications.
CO3: Explore the various membership functions of fuzzy logic.
CO4: Observe genetic algorithm and its applications
CO5: Apply hybrid soft computing techniques in suitable tasks.

TEXT BOOKS:

T1 S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.
T2 S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.

REFERENCE BOOKS:

R1 S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis &Applications", Prentice-Hall of India Pvt. Ltd., 2006
R2 Timothy j ross fuzzy logic with engineering appilication second edition wiley studentedition 2005
R3 George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7307	COMMUNICATION ENGINEERING	3	0	0	3

Course Objective

1. Introduce the different methods of analog communication and their significance
2. Impart knowledge on Digital Communication methods for high bit rate transmission
3. Explain the concepts of data communication and coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
4. Outline the MAC used in communication systems for enhancing the number of users.
5. Figure out various optical fiber modes, configurations and various signal degradation factors associated with optical fiber

Unit	Description	Instructional Hours
I	**ANALOG COMMUNICATION** Amplitude modulation and demodulation circuits – Frequency modulation and demodulation circuits - Super heterodyne radio receiver.	9
II	**DIGITAL COMMUNICATION** Pulse code modulation – concepts of sampling and sampling theormes, time division multiplexing - digital T-carrier system.-Digital radio system. - Digital modulation,- Frequency and phase shift keying – Modulator and demodulator - bit error rate calculation - applications of Data communication.	9
III	**DATA COMMUNICATION AND NETWORK PROTOCOL & ERROR CONTROL** Primary communication - Data Communication codes - error control - Serial and parallel interface - telephone network- data modem – ISDN- LAN- ISO - OSI seven layer architecture for WAN- Error control codes and applications - convolutions & block codes.	9
IV	**MULTIPLE ACCESS TECHNIQUES** SS&MA techniques : FDMA –TDMA – CDMA - SDMA application in wire and wireless communication : Advantages (merits)	9
V	**SATELLITE, OPTICAL FIB.E.R COMMUNICATION** Orbital satellites - geostationary satellites - look angles - satellite system link models- satellite system link equations - advantages of optical fibre communication - Light propagation through fibre -fibre loss, -light sources and detectors.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Experience on analog communication. and demodulation
CO2: Analyze the performance of a sampling and pass band digital communication system in terms of error rate and calculation .
CO3: Perform the network protocol and error control codes of the signals in a data communication system.
CO4: Know about the multiple access techniques, transmission medium and error control.
CO5: Gather expose on satellite and optical fibre communication.

TEXT BOOKS:

T1 Wayne Tomasi, Electronic Communication Systems, Pearson Education Asia Ltd, 3rd Edition, New Delhi, 2001

T2 Taub & Schiling "Principles of Communication Systems" Tata McGraw Hill 2007.

REFERENCE BOOKS:

R1 J.Das "Principles of Digital Communication" New Age International, 1986.

R2 Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition, 1993.

R3 B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press, 1998.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE7308	SPECIAL ELECTRICAL MACHINES	3	0	0	3

Course Objective

1. Identify the special electrical motors for specific applications.
2. Select a suitable controller for controlling stepping motors.
3. Identify a suitable power converter for improving the performance of switched reluctance motors.
4. Describe the controllers for controlling the speed of permanent magnet brushless D.C. motors.
5. Discuss the sensorless control of permanent magnet synchronous motors.

Unit	Description	Instructional Hours
I	**SPECIAL ELECTRICAL MOTORS** Introduction to Special Electrical Machines - Constructional features and Working Principles: AC series motor - Repulsion motor - Hysteresis motor - Single phase Reluctance Motor - Universal Motor - AC & DC Servo motors - Applications	9
II	**STEPPER MOTORS** Introduction - Types of stepper motors - Constructional features - Principle of operation - Variable Reluctance motor - Single and multi stack configurations - Permanent Magnet Stepper Motor - Hybrid Stepper motor - Open loop control of 3 phase VR stepper motor - Torque equations - Characteristics - Microprocessor control of stepper motors - Applications	9
III	**SWITCHED RELUCTANCE MOTORS (SRM)** Introduction - SRM configurations - Rotary SRM - Constructional features - Principle of operation - Torque Equation and characteristics – Characteristics - Power Converters - Two switching devices per phase - (n+1) switching devices and (n+1) diodes – Split-link - C-dump - Rotor position sensor - Microprocessor based control of SRM drive - Sensor less operation - Applications	9
IV	**PERMANENT MAGNET BRUSHLESS D.C. MOTORS (PM BLDC)** Permanent Magnet materials - Construction - Electronic Commutation - Principle of Operation – BLDC Square wave Motor - Control of BLDC Motor - Microprocessor based control of BLDC Motor - DSP based control of BLDC Motor - Sensorless control of BLDC Motor - Applications	9
V	**PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)** Principle of operation - EMF and Torque equations - Phasor Diagram - Control of PMSM - Microprocessor based control of PMSM Motor - DSP based control of PMSM Motor - Sensorless control of PMSM Motor - Applications	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify various special electrical motors for specific applications.
CO2: Control the speed of the Stepper motor using an appropriate controller.
CO3: Select an appropriate power converter of Switched Reluctance Motor drive for different applications.
CO4: Develop a speed controller for Brushless DC Motors using microprocessor.
CO5: Illustrate the working of Permanent Magnet Synchronous Motor by using sensorless control.

TEXT BOOKS:

T1 E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.
T2 K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

REFERENCE BOOKS:

R1 R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001
R2 P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
R3 T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.

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PROFESSIONAL ELECTIVE-V

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8301	APPLICATION OF POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	3	0	0	3

Course Objective

1. Impart the knowledge various operation and analysis of renewable energy systems.
2. Study the power converters used for PV systems.
3. Learn the power inverters used for Wind energy systems.
4. Analyze the Grid connection and its issues in renewable energy systems.
5. Enumerate the algorithm used for hybrid renewable energy systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell and hybrid renewable energy systems (Qualitative Study)	9
II	**ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION** Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG. (Qualitative Study)	9
III	**POWER CONVERTERS** Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) – DC to DC Converter – types & comparison - Boost and buck-boost converters- selection of inverter, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters	9
IV	**ANALYSIS OF WIND AND PV SYSTEMS** Solar: Stand alone operation of solar system - Grid Integrated solar system - Grid connection Issues Wind: Stand alone operation of fixed and variable speed wind energy conversion systems and - Grid integrated PMSG, SCIG Based WECS- Grid connection Issues	9
V	**HYBRID RENEWABLE ENERGY SYSTEMS** Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV hybrid systems – Types of Maximum Power Point Tracking (MPPT) algorithm - Perturb and observe - Incremental conductance. CASE STUDY:"Applications of power electronics switches in renewable energy systems"	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Familiarized the basic of renewable energy systems..
CO2: Design the different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
CO3: Analysis the operation of solar and wind systems at stand alone and Grid integrated system
CO4: Develop the hybrid renewable energy systems
CO5: Intend the algorithm of MPPT technique used in wind energy systems.

TEXT BOOKS:

T1 B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 2009.
T2 Rai. G.D, —Non conventional energy sources, Khanna publishes, 1993.

REFERENCE BOOKS:

R1 Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
R2 Solanki Chetan Singh, "Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2011
R3 Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8302	BIOMEDICAL INSTRUMENTATION	3	0	0	3

Course Objective

1. Recall human physiological system and fundamentals of biomedical engineering.
2. Identify the non-electrical parameters of measurement systems.
3. Understand the electrical parameters of measurement systems and electrical safety.
4. Describe the various imaging techniques.
5. Discuss about life assisting and therapeutic equipments.

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF BIOMEDICAL ENGINEERING** Cell and its structure – Resting and Action potential – Nervous system and its fundamentals - Physiological systems of thee body-Cardiovascular systems, Respiratory systems – Bioelectric signals- Basic components of a biomedical system.	9
II	**NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES** Measurement of blood pressure - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter.	9
III	**ELECTRICAL PARAMETERS ACQUISITION AND ELECTRICAL SAFETY** Electrodes – Limb electrodes – floating electrodes - Micro, needle electrodes–ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current	9
IV	**IMAGING TECHNIQUES AND ANALYSIS** Radio graphic and Fluoroscopic techniques – Computer Tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.	9
V	**LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES** Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the human physiological system and fundamentals of biomedical engineering.
CO2: Examine the non-electrical parameters measurement systems.
CO3: Evaluate the electrical parameters measurement systems and electrical safety.
CO4: Analyze the various imaging techniques.
CO5: Enumerate the life assisting and therapeutic equipments.

TEXT BOOKS:

T1 Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

T2 Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

REFERENCE BOOKS:

R1 - John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.

R2 - M.Arumugam, "Bio-Medical Instrumentation", Anuradha Agencies, 2003.

R3 - Joseph J.carr and John M. Brown, "Introduction to Biomedical Equipment Technology", John Wiley and sons, 4th Edition, 2012

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8303	POWER SYSTEM DYNAMICS	3	0	0	3

Course Objective

1. Analyze the fundamentals of power system dynamics.
2. Recall dynamic modeling of a synchronous machine.
3. Describe the modeling of excitation and speed governing system.
4. Analyze the fundamental concepts of stability of dynamic systems.
5. Interpret and enhance the transient stability simulation of multi machine power system.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design – distinction between transient and dynamic stability.	9
II	**SYNCHRONOUS MACHINE MODELLING** Synchronous machine - flux linkage equations - Park's transformation - per unit conversion -normalizing the equations - equivalent circuit - current space model - flux linkage state space model - Sub-transient and transient inductances - time constants.	9
III	**MACHINE CONTROLLERS** Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. - function of speed governing systems.	9
IV	**TRANSIENT STABILITY** State equation for multi machine system with one axis model and simulation – modelling of multi-machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer.	9
V	**DYNAMIC STABILITY** System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact – linearization of the load equation for the one machine problem – simplified linear model – dynamic performance measure - small signal performance measures.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify the basics of power system dynamics.
CO2: Analyze dynamic modeling of a synchronous machine.
CO3: Develop the models for excitation and speed governing system.
CO4: Explain the fundamental concepts of stability of dynamic systems.
CO5: Examine the small signal stability problem in power systems.

TEXT BOOKS:

T1 P. Kundur, 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010

T2 M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.

REFERENCE BOOKS:

R1 L. P. Singh, 'Advanced Power System Analysis and Dynamics', New Age International Publishers, Fourth Edition, 2006

R2 R. Ramanujam, 'Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, second printing, 2010

R3 P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Wiley-IEEE Press, second edition, 2003

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8304	ENERGY MANAGEMENT AND ELECTRICAL SAFETY	3	0	0	3

Course Objective

1. Discuss the concepts of power factor, load management etc.
2. Interpret the various measures for energy conservation in electrical static machineries.
3. Infer the various measures for energy conservation in electrical rotating machineries.
4. Describe the illumination and energy efficient devices.
5. Illustrate the practical measures of Electrical Safety

Unit	Description	Instructional Hours
I	**BASICS OF ELECTRICAL ENERGY USAGE** Fuel to Power : Cascade Efficiency – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption – Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction – Demand Side Management	9
II	**TRANSFORMERS & MOTORS** Transformer – Basics & Types – AVR & OLTC Concepts –Selection of Transformers – Performance Prediction - Energy Efficient Transformers – Motors : Specification & Selection – Efficiency / Load Curve – Load Estimation – Assessment of Motor Efficiency under operating conditions – Factors affecting performance – effects of Rewinding & Oversizing - Energy Efficient Motors	9
III	**FANS / PUMPS / COMPRESSORS** Basics – Selection – Performance Evaluation – Cause for inefficient operation – Energy conservation in Centrifugal pumps, Fans & Blowers, Air compressor – Energy consumption & energy saving potentials – Design consideration.	9
IV	**ILLUMINATION & ENERGY EFFICIENCY DEVICES** Specification of Luminaries – Types – Efficacy – Selection & Application – ENCON Avenues & Economic Proposition - New Generation Luminaries (LED / Induction Lighting) - Soft Starters / Auto Star – Delta – Star Starters / APFC / Variable Speed & Frequency Drives – Time Sensors – Occupancy Sensors	9
V	**ELECTRICAL SAFETY** Hazards of Electricity – Safety Procedures and methods – Grounding of Electrical systems and equipment – Accident prevention, Accident investigation, Rescue and first aid – safety training methods and systems	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Calculate different Electricity tariff , penalty concepts
CO2: Design energy efficient transformers
CO3: Identify the Energy saving opportunities in pumps
CO4: Design proper lighting scheme with Energy saving opportunities
CO5: Summarize the Electrical safety rules

TEXT BOOKS:

T1 Andreas Sumper, Angelo Baggini "Electrical Energy Efficiency: Technologies and Applications", John Wiley & Sons, 2012

T2 Frank Kreith, D. Yogi Goswami "Energy Management and Conservation Handbook", Second Edition, CRC Press, 2016

REFERENCE BOOKS:

R1 John Cadick, P.E.,, Mary Capelli-Schellpfeffer, et.al., "Electrical Safety Handbook", Fourth Edition Mcgraw-hill, 2012

R2 Handbook on Energy Efficiency, TERI, New Delhi, 2001

R3 Kraushaar and Ristenen, "Energy and Problems of a Technical Society", 1993.

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PROFESSIONAL ELECTIVE-VI

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8305	COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS	3	0	0	3

Course Objective

1. Familiarize with Finite Element Method as applicable for Electrical Engineering
2. Calculate the losses and electrical parameters in field and energy equations
3. Analyze steady state equations of AC machines
4. Explore the usage of organization of a typical CAD package
5. Develop the applications of design of several Electrical apparatus.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - The Galerkin's Finite element method - Boundary conditions - Magnetostatic example - Non linear Problems : Representation of B-H curve - The basic Newton-raphson method for a single equation.	9
II	**COMPUTATION OF LOSSES, RESISTANCE AND INDUCTANCE** Conventional design procedures - Limitations - Computation of eddy current losses - Losses in an series winding - Inductance and Reactance - Calculation of Force and Torque : Ampere's force law - Maxwell's stress method - Using machine models to find Torque.	9
III	**AC MACHINES IN THE STEADY STATE** Basic configuration of Synchronous Machine - Steady state operation - Modeling considerations - Excitation calculations - Computation of Steady state reactances - Direct Axis Transient and Sub transient reactances. Frequency response curves	9
IV	**CAD PACKAGES** Elements of a CAD System - Pre-processing - Modeling - Meshing - Material properties- Boundary Conditions - Setting up solution - Post processing.	9
V	**DESIGN APPLICATIONS** Voltage Stress in Insulators - Capacitance calculation - Design of Solenoid Actuator - Inductance and force calculation - Torque calculation in Switched Reluctance Motor.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify an appropriate design using finite element analysis for electromagnetic study.
CO2: Derive the power and energy equations and calculate the electrical losses
CO3: Develop the mathematical model of steady state analysis for AC machines
CO4: Explain the concepts of organization of CAD packages.
CO5: Select the appropriate design procedures of different Electrical apparatus.

TEXT BOOKS:

T1 S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995
T2 Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor& Francis, 2005

REFERENCE BOOKS:

R1 P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
R2 D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986
R3 S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8306	INDUSTRIAL ELECTRONICS	3	0	0	3

Course Objective

1. Understand the concept of power supplies and filters
2. Analyze the firing circuits using power semiconductor devices
3. Study about the power converters
4. Analyze the control of electric drives using converters.
5. Study the applications of converters in industries.

Unit	Description	Instructional Hours
I	**POWER SUPPLIES** Introduction to power supply- filters and types – voltage multiplier: half wave and full wave voltage doubler- voltage regulator LM340- flyback converter.	9
II	**FIRING CIRCUITS** Overview of firing devices- firing characteristics of unijunction transistor- relaxation oscillator- thyristor firing using DIAC- different methods of triggering SCR circuits- causes of damage to SCRs.	9
III	**POWER CONVERTERS** Single phase parallel inverter with feedback diodes- single phase series inverter – AC chopper – Chopper control techniques- gas filled diode- loss of power in semiconductor devices.	9
IV	**MOTOR CONTROL** Zero voltage switch - Synchronous Tapchanger - phase control of DC motor- AC power control of a Lamp Dimmer- Chopper control of DC series Motor- Advantages of AC motor control over DC motor control.	9
V	**INDUSTRIAL APPLICATIONS** Battery charger circuit – dielectric heating - Online and offline Uninterrupted power supply – Switched mode power supply – Principle and application of induction heating.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design the power supplies for electronic circuits
CO2: Design the firing circuits for converters
CO3: Choose the power converter for industrial application
CO4: Employ soft switching technique to control AC and DC motors.
CO5: Troubleshoot the various domestic and industrial appliances.

TEXT BOOKS:

T1 Biswanath paul, "Industrial Electronics and Control", Prentice Hall of India, 2002.
T2 Thomas E Kissell, "Industrial Electronics", Prentice Hall of India, 2006.

REFERENCE BOOKS:

R1 Akhilesh R Uadhayay, L P Singh, A K Gupta, "Industrial Electronics", Dhanpat Rai Publishing Company, 2005.
R2 Vanvalkenburgh, Nooger & Neville, "Solid State Electronics", Cengage Learning, 2009.
R3 Paul B Zbar, "Industrial Electronics", Tata McGraw Hill, 1983.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8307	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	3	0	0	3

Course Objective

1. Identify the concept and planning of HVDC power transmission
2. Discuss the HVDC converters
3. Study about the HVDC system control and reactive power
4. Correlate the harmonics and design of filters.
5. Review power flow and simulation of HVDC system.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction of DC power transmission technology-Comparison of AC and DC transmission-Types of DC link- description of converter station –Planning for HVDC transmission-Modern trends in HVDC technology-Applications of HVDC system-Types and applications of MTDC systems.	9
II	**ANALYSIS OF HVDC CONVERTER** Pulse number-Analysis of Line Commutated Converter (LCC)-Two and Three valve conduction mode- Three and Four valve conduction mode LCC Bridge characteristics-Rectifier-Inverter –Characteristics of 12 pulse converter.	9
III	**CONVERTER AND HVDC SYSTEM CONTROL** Principles of DC link control-starting and stopping of DC link-Control Characteristics – system control hierarchy-Firing angle control-Current and extinction angle control-Power control-Higher level controllers-Frequency and Power / Frequency control.	9
IV	**REACTIVE POWER AND HARMONIC CONTROL** Sources of reactive power-SVC-STATCOM-Generation of harmonics-Types of AC and DC Filters-Design of single tuned AC Filters-DC Filters-Active Filters-Power line Communication and RI Noise.	9
V	**POWER FLOW ANALYSIS AND SIMULATION OF HVDC SYSTEMS** Per unit system for DC quantities-DC system model-Power flow analysis-case study-HVDC system simulation: Philosophy, Tools and applications-HVDC system simulation-Digital dynamic Simulation.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain Planning and Modern trends in HVDC technology.
CO2: Design HVDC converter system.
CO3: Summarize the converter control configurations used in HVDC transmission
CO4: Generalize filters for eliminating harmonics and design of AC filters.
CO5: Criticize the power flow analysis and HVDC system simulation

TEXT BOOKS:

T1 Padiyar, K.R., "HVDC Power Transmission system",New Age International (P) Ltd., New Delhi, Second Edition, 2010

T2 Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Wiley interscience, New York, London, Sydney, 1971

REFERENCE BOOKS:

R1 Colin Adamson and Hingorani N G, "High Voltage Direct Current Transmission",Garraway Limitted, London,1960

R2 S.Kamakshaiah, V.Kamaraju, "HVDC Transmission",Tata Mc Graw Hill Education Private Limited, 2011.

R3 Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.

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Programme	Course Code	Name of the course	L	T	P	C
B.E.	16EE8308	TOTAL QUALITY MANAGEMENT	3	0	0	3

Course Objective

1. Analyse the quality concepts and determine the voice of the customer
2. Understand the TQM concepts like Employee Focus and their involvement, continuos process improvement and Supplier Management
3. Provide exposure to students on the basic and new seven management tools,Quality concepts like Six sigma, Failure mode effect analysis.
4. Explore industrial applications of Quality function deployment, taguchi quality concepts and TPM.
5. Impart detailed exposure to students on various quality systems like ISO and its standards.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - Need for quality - Evolution of quality -Definitions of quality –Dimensions of product and service quality - Basic concepts of TQM -TQM Framework - Contributions of Deming, Juran - Barriers to TQM -Quality statements - Customer focus - Customer orientation, Customer Satisfication, Customer complaints, Customer retention - Costs of quality.	9
II	**TQM PRINCIPLES** Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership –Supplier selection , Supplier Rating.	9
III	**TQM TOOLS AND TECHNIQUES I** The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types	9
IV	**TQM TOOLS AND TECHNIQUES II** Control Charts - Process Capability – Quality Function Development (QFD) – Taduchi Quality Loss Function - TPM - Concepts, improvement needs - Performance measures.	9
V	**QUALITY SYSTEMS** Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in Manufacturing and service sectors.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Gain basic knowledge in total quality management relevant to both manufacturing and service industry including IT sector.
CO2: Implement the basic principles of TQM in manufacturing and service based organization.
CO3: Apply the tools and techniques of quality management to manufacturing and services processes.
CO4: Apply the tools and techniques of quality management to manufacturing and services processes.
CO5: Gain the knowledge on various ISO standards and quality systems

TEXT BOOKS:

T1 Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2006

T2 James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

REFERENCE BOOKS:

R1 Feigenbaum.A.V. "Total Quality Management", McGraw Hill.

R2 Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

R3 Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006

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OPEN ELECTIVE - II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE7401	LABVIEW FOR ENGINEERING APPLICATIONS	3	0	0	3

Course Objective

6. Infer the knowledge about virtual instrumentation.
7. Transform the conventional programming to data flow programming.
8. Discuss the various instrument interface and protocol.
9. Integrate the hardware with LabVIEW Programming via DAQ system.
10. Build the application via graphical programming knowledge.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Architecture of Virtual Instrumentation – Virtual Instruments Vs Traditional Instruments – Graphical System Design using LabVIEW-Conventional and Graphical Programming.	9
II	**GRAPHICAL PROGRAMMING AND LabVIEW** Concepts of graphical programming – LABVIEW software – Concept of VIs and sub VI - Loops - Structures - Arrays – Clusters-Local and global variables – String and file I/O.	9
III	**INSTRUMENT INTERFACES AND PROTOCOLS** RS232, RS422, RS485 and USB standards - IEEE 488 standard – Introduction to bus protocols of MOD bus and CAN bus.	9
IV	**DATA ACQUISITION (DAQ) AND INSTRUMENT CONTROL** Components of DAQ- Hardware components of DAQ -Analog I/O and Digital I/O- Configuration of DAQ -Instrument control: VISA, GPIB.	9
V	**ADVANCED LABVIEW APPLICATIONS** Applications of LabVIEW: Process control, Biomedical, Image acquisition and Processing, Power quality monitoring.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Interpret knowledge on virtual instrumentation using LabVIEW.
CO2: Perform the basic programming with LabVIEW palettes.
CO3: Outline concept of various instrument interfaces with LabVIEW.
CO4: Employ the role of DAQ concepts for interfacing hardware components.
CO5: Implementing the LabVIEW in various engineering application.

TEXT BOOKS:

T1 - Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW", Tata McGraw-Hill, Second Edition, 2010.
T2 - Jovitha Jerome, "Virtual Instrumentation using LabVIEW" Prentice Hall, 2010.

REFERENCE BOOKS :

R1 - Gary W. Johnson, Richard , "LabVIEW Graphical Programming", Tata McGraw Hill Professional Publishing, 2006.
R2 - Lisa K Wells & Jeffrey Travels, "LabVIEW for Everyone", Prentice Hall, 2003.
R3 - Robert H. Bishop, "Learning with LabVIEW", Prentice Hall, 2009.
R4 - Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes - Elsevier Publications, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE7403	BASICS OF SOLAR PHOTOVOLTAIC SYSTEMS	3	0	0	3

COURSE OBJECTIVE

1. To study the Energy Scenarios and Its Impacts.
2. To describe the basics of solar energy radiation and its measurements
3. To understand the various types cell technologies and arrangement of PV modules.
4. To impart knowledge on the balance of solar PV systems.
5. Tounderstand thevarious applications of solar photovoltaic systems

Unit	Description	Instructional Hours
I	**ENERGY RESOURCES** World Energy Use - Primary energy sources – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in Tamilnadu, India and around the World – Potentials – Achievements / Applications – Economics of renewable energy systems.	9
II	**SOLAR ENERGY BASICS & MEASUREMENT** Sun's Energy Advantages-Energy conversion challenges- Solar Constant-Solar Radiation at the Earth's Surface-Solar Radiation-Geometry -Local Solar Time (LST). Local Apparent Time (LAT)-Sunrise, Sunset and Day length. Solar Radiation Measurements: Pyrheliometer – Pyronometer.	9
III	**SOLAR CELL TECHNOLOGY** Solar cell Technologies-Types- Solar PV Modules from solar cells-Series and parallel connection of cells-Mismatch in cell / module- Mismatch in series and parallel connection- Hot spot in the module-Bypass diode- No. of solar cells in a module-Wattage of modules-PV module power output.	9
IV	**BALANCE OF SOLAR PV SYSTEMS** Introduction to batteries-Factors affecting battery performance-Types of Batteries for PV systems-Comparison of batteries-Importance and Types of charge controller- Necessity & types of inverter - Maximum Power Point Tracking (MPPT) System	9
V	**APPLICATIONS OF PV SYSTEM** A Basic Photovoltaic Systems for power generation- Grid Interactive solar PV Power system-Applications of solar Photovoltaic system-Solar street lighting-home lighting system-Water pumping system. (Block Diagram Approach)	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Aby demand and environmentampacts.
CO2: Ability to explain the different solar measurement techniques.
CO3: Ability to develop the solar modules.
CO4: Ability to understand different supporting components of Solar PV systems.
CO5: Ability to explain the applications of Solar PV systems

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

Semester – I R2019

Course Code & Name : 19HE1101 & Technical English

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name: 19MA1103 & Calculus and Differential Equations

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 19PH1151 & Applied Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

Course Code & Name : 19CY1151 - Chemistry for Engineers

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

Course Code & Name -19CS1151- Python Programming and Practices

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

Course Code & Name -19ME1152- Engineering Drawing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	1	-	1	-	-	1	1	1	1	2
CO2	3	3	2	1	1	-	1	-	-	1	1	1	1	2
CO3	3	3	3	-	1	1	1	-	-	1	1	-	1	1
CO4	3	3	3	1	1	2	1	-	-	1	1	1	1	1
CO5	3	3	3	1	1	3	1	-	-	1	1	1	1	1
Avg	2.8	3	2.6	1	1	2	1	-	-	1	1	1	1	1.4

SEMESTER II

Course Code & Name -19HE2101- Business English for Engineers

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name -19MA2102- Complex Variables and Transform Calculus

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	1.8

Course Code & Name -19PH2151- Material Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name -19CY2151- Environmental Studies

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name -19CS2152- Essentials of C & C++ Programming

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

Course Code & Name -19EE2151- Circuit Theory

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
CO3		1	1										3	
CO4													3	3
CO5			1		1								3	3
Avg	2	1.5	1		1								3	3

Course Code & Name -19ME2001- Engineering Practices

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

SEMESTER III

Course Code & Name -19MA3102- Fourier Analysis and Transforms

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 -19EE3201- Electronic Devices and Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2				1				1	3	3
CO2	2	2	3	2				1				1	3	3
CO3	3	2	3	2				1				1		3
CO4	2	2	3	2				1				1		3
CO5	2	2	3	2				1				1		3
Avg	2.2	2	3	2	0	0	0	1	0	0	0	1	3	3

Course Code & Name -19EE3202- Electrical Machines I

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

Course Code & Name -19EE3203- Field Theory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	1	-	-	-	-	-	3	-
CO2	3	3	1	2	-	-	1	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	1	1	-	-	-	-	3	-
CO4	3	2	1	1	-	2	1	1	-	-	-	-	3	-
CO5	3	2	2	2	-	2	2	2	-	-	-	-	3	-
Avg	3	2.6	1.6	1.8	-	2	1.2	1.3	-	-	-	-	3	-

Course Code & Name -19EE3251- Electrical and Electronic Measurements

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	1	2	2	0	3	0	3	3	3	0
CO2	3	2	1	3	1	2	2	0	3	0	0	1	3	3
CO3	3	2	1	3	1	2	2	0	3	0	0	1	3	0
CO4	2	2	1	3	1	2	2	0	3	0	0	1	3	3
CO5	3	2	1	3	1	2	2	0	3	0	0	1	3	0
Avg	2.6	2	1.2	3	1	2	2	0	3	0	3	1.4	3	3

Course Code & Name -19EE3001- Electronic Devices and Circuits Laboratory

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

Course Code & Name -19EE3002- Electrical Machines Laboratory

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

SEMESTER IV

Course Code & Name -19MA4101- 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- 19EE4201- Electrical Machines II

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

Course Code & Name- 19EE4202- Integrated Circuits and its Applications

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	3	2	1	2	0	2	2	3	3	3
CO2	3	3	3	3	3	2	1	2	0	3	0	3	3	3
CO3	3	3	3	3	3	2	1	2	0	3	0	3	3	3
CO4	3	3	3	3	3	2	0	2	0	2	0	3	3	3
CO5	2	3	3	3	3	2	0	2	0	2	0	3	3	3
Avg	2.6	3	3	2.8	3	2	1	2	0	2.667	2	3	3	3

Course Code & Name -19EE4203- Digital Signal Processing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3			2	1				3	3	3
CO2	2	2	3	2				1					3	3
CO3	3	3	3	2			2	1					3	3
CO4	3	3	3				1	1				3	3	3
CO5	3	3	3				1	1				3	3	3
Avg	2.6	2.6	3	2.3	0	0	1.5	1	0	0	0	3	3	3

Course Code & Name -19EE4251- Digital Logic Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	1	2	1	2	3	2	0	3	3	0
CO2	2	3	2	3	3	2	1	2	3	2	0	3	3	0
CO3	3	3	2	3	3	2	2	2	3	2	0	3	3	0
CO4	2	3	2	3	3	2	1	2	3	2	0	3	3	3
CO5	3	3	2	3	3	2	2	2	3	2	0	3	3	3
Avg	2.4	2.8	2.2	2.8	2.6	2	1.4	2	3	2	0	3	3	3

Course Code & Name -19EE4001- Electrical Machines Laboratory II

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

Course Code & Name -19EE4002- Integrated Circuits Laboratory

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2	1	3	3	3	0	3	3	3
CO2	3	3	2	3	3	2	1	3	3	3	0	3	3	3
CO3	3	3	3	3	3	2	1	3	3	3	0	3	3	3
CO4	3	3	3	3	3	2	1	3	3	3	0	3	3	3
CO5	2	3	3	3	3	2	1	3	3	3	0	3	3	3
Avg	2.8	3	2.6	3	3	2	1	3	3	3	0	3	3	3

SEMESTER V R2016

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
CO2	2	1	3										2	2
CO3	2	3	1		2								3	3
CO4	1		2	3	2							2	3	3
CO5	3	3	3		3							2	2	1
Avg	2.2	2	2.2	3	2.3							1.6	2.6	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

SEMESTER VI

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	1.333333333

SEMESTER VII

Course Code & Name -16EE7201- Solid State Drives

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

Course Code & Name -16EE7202- Electrical Energy Utilization and Conservation

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

Course Code & Name -16EE7203- Power System Operation and Control

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 -16EE7303- Solar Photo Voltaic Fundamentals & Applications

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3		3			2						3	
CO2	3			3			2	2					3	3
CO3	3	2			3								3	3
CO4	2				3		3	3						3
CO5	2				3									3
Avg	2.6	2.5		3	3		2.3	2.5					3	3

Course Code & Name -16EE7308- Special Electrical Machines

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	
CO3	2	1	3										3	
CO4	2	3	1										2	
CO5	2	2	2											
Avg	2	2.25	2.2										2.25	

Course Code & Name -16EE7001- Drives and Control Laboratory

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

SEMESTER VIII

Course Code & Name -16EE8301- Application of Power Electronics for Renewable Energy Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2					2	2							2
CO2	1	1	3				1						2	1
CO3	1	2	2				1						1	1
CO4	2	2					1						2	2
CO5	2	1					1						1	1
Avg	1.6	1.5	2.5			2	1.2						1.5	1.4

Course Code & Name -16EE8307- High Voltage Direct Current Transmission

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	

Chairman Board of Studies

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