RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

THIRD SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
GS	BEEE3O1T	Electrical Engineering Mathematics	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE3O2T	Network Analysis	3	-	1A	4	4	30	70	-	-	100	45	
EE	BEEE3O3T	Electrical Measurement & Instrumentation	3	-	1A	4	4	30	70	-	-	100	45	
EE	BEEE3O4T	Analog Devices & Circuits	3	-	1A	4	4	30	70	-	-	100	45	
EE	BEEE3O5T	Renewable Energy studies	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE3O6T	Introduction to Python programming	1	-	-	1	1	15	35	-	-	50	23	
	BEEE3O7T	Environmental studies	1	-	-	1	Audit	50	-	-	-	Audit	-	
EE	BEEE3O2P	Network Analysis Lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE3O3P	Electrical measurement & instrumentation Lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE3O4P	Analog Devices & circuits Lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE3O6P	Introduction to Python programming Lab	-	2	-	2	1	-	-	25	25	50		25
		Total	**17**	**8**	**1T+3A**	**29**	**24**	**165**	**385**	**100**	**100**	**750**		

- L- Lecture, P-Practical(Half Credit per Hour), T- Tutorial, A- Activity

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

FOURTH SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
EE	BEEE4O1T	Signal & Systems	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE4O2T	Digital Electronics	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE4O3T	Electrical machines-I	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE4O4T	Power System	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE4O5T	Electromagnetic Fields	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE4O6T	Programming Techniques & Simulation	3	-	-	3	3	30	70	-	-	100	45	
		Internship (2 to 3 weeks)	-	-	-	-	1	-	-	-	-	-		
EE	BEEE4O2P	Digital Electronics lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE4O3P	Electrical machines-I Lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE4O6P	Programming Techniques & Simulation Lab	-	2	-	2	1	-	-	25	25	50		25
		Total	**18**	**6**	**2T**	**26**	**24**	**180**	**420**	**75**	**75**	**750**		

- L- Lecture, P-Practical(Half Credit per Hour), T- Tutorial, A- Activity

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

FIFTH SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
EE	BEEE5O1T	Microprocessor & Microcontroller	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE5O2T	Control systems	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE5O3T	Power electronics	3	-	1T	4	4	30	70	-	-	100	45	
	BEEE5O4T	Open elective -I	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE5O5T	Professional elective-I	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE5O1P	Microprocessor & Microcontroller lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE5O2P	Control systems lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE5O3P	Power Electronics lab	-	2	-	2	1	-	-	25	25	50		25
		Total	**15**	**6**	**3T**	**24**	**21**	**150**	**350**	**75**	**75**	**650**		

- L- Lecture, P-Practical(Half Credit per Hour), T- Tutorial, A- Activity

Open Electives -I	Professional Elective-I
1. PLC and SCADA systems	1. Electrical Machine – II
2. Solar PV Systems	2. Power Station Practice
3. Organizational behavior	3. Electrical Power Utilization

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

SIXTH SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
GS	BEEE6O1T	Engineering Economics & Management	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE6O2T	Computer Applications in power system	3	-	1T	4	4	30	70	-	-	100	45	
EE	BEEE6O3T	Switch gear & protection	3	-	1T	4	4	30	70	-	-	100	45	
	BEEE6O4T	Open electives-II	2	-	-	2	2	30	70	-	-	100	45	
EE	BEEE6O5T	Professional elective-II	3	-	-	3	3	30	70	-	-	100	45	
	BEEE6O6T	Yoga & Meditation	1	-	-	1	Audit	50	-	-	-	Audit		
		Internship 3 to 4 weeks	-	-	-	-	2	-	-	-	-	-		
EE	BEEE6O2P	Computer Applications in power system lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE6O3P	Switch gear & protection lab	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE6O7P	Electrical Workshop Lab	-	2	-	2	1	-	-	25	25	50		25
		Total	**15**	**6**	**2T**	**23**	**21**	**150**	**350**	**75**	**75**	**650**		

- L- Lecture, P-Practical(Half Credit per Hour), T- Tutorial, A- Activity

Open Electives -II	Professional Elective-II
1. Testing and maintenance of Electrical Equipments	1. Electrical Installation and Design
2. Advance Instrumentation	2. Electrical Machine Design
3. Optimization Technique	3. Electric Drives and their control

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

SEVENTH SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
EE	BEEE7O1T	Professional elective-III	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE7O2T	Professional elective-IV	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE7O3T	Professional elective-V	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE7O4T	Open electives-III	3	-	-	3	3	30	70	-	-	100	45	
	BEEE7O5T	Ancient Indian History	-	-	-	-	Audit	50	-	-	-	Audit		
EE	BEEE7O6P	Elective Lab-I	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE7O7P	Elective Lab-II	-	2	-	2	1	-	-	25	25	50		25
EE	BEEE7O8P	Project &Seminar	-	-	3A	3	3	-	-	50	-	50		25
		Total	**12**	**4**	**3A**	**19**	**17**	**120**	**280**	**100**	**50**	**550**		

- L- Lecture, P-Practical(Half Credit per Hour), T- Tutorial, A- Activity

Open Electives III	Professional Elective III	Professional Elective IV	Professional Elective V
1. Energy Management and Audit	1. Advanced Power Electronics	1. Fuzzy Logic and Neural Networks	1. Introduction to Artificial Intelligence
2. Industrial Economics and Entrepreneurship	2. HV Engineering	2. Advanced Electrical Power Systems	2. Digital signal processing and its applications
3. Electric and Hybrid Vehicles	3. Integrated Renewable Energy Systems	3. Flexible AC Transmission System	3. Introduction to Smart Grid

Elective lab I	Elective lab II
1) HV Engineering OR 2) Electrical Drawing and Simulation	1) Electrical Installation & Design OR 2) Advance Power Electronics

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering) (CBCS)
SCHEME OF EXAMINATION

EIGHTH SEMESTER

Board	Subject Code	Subject	Teaching Scheme				Credit	MARKS					Minimum Passing Marks	
								Theory		Practical		Total	Theory	Practical
			L	P	T/A	Total		Internal	Uni.	Internal	Uni.			
EE	BEEE8O1T	Advance Professional elective-VI #*	3	-	-	3	3	30	70	-	-	100	45	
EE	BEEE8O2T	Advance Professional elective-VII #*	3	-	-	3	3	30	70	-	-	100	45	
		Internship (5 to 6 weeks) in Industry at appropriate work place	-	-	-	-	4	-	-	-	-	-		
EE	BEEE8O3P	Project	-		3A	3	3	-	-	50	50	100		50
EE	BEEE8O4P	Seminar	-	-	2A	2	2	-	-	50	-	50		
		Total	**6**	**-**	**5A**	**11**	**15**	**60**	**140**	**100**	**50**	**350**		

 # These subjects should be undertaken through online mode.

***Alternatively students can choose any course with 3 credits from MOOCs Platform for which the list is given below.**

Additional subjects may be conducted through online courses.

Teacher shall be assigned workload for internship and industrial project.

List of MOOCs platforms which offer online certifications courses as below: -

1. **SWAYAM-https://swayam.gov.in**
2. **NPTEL-https://onlinecourses.nptel.ac.in**
3. **MOOC-http://mooc.org**

OR

Students may opt following online courses designed by BoS Electrical Engineering, RTMNU Nagpur

Professional Elective-VI	Professional Elective-VII
1. Power semiconductor drives	1. EHVAC / DC transmission System
2. Electrical Distribution System	2. Power Quality

LIST OF ELECTIVE SUBJECTS

Semester	Elective Type	Subject
V	Open Elective-I	1. PLC and SCADA systems
		2. Solar PV Systems
		3. Organizational behavior
	Professional Elective-I	1. Electrical Machine – II
		2. Power Station Practice
		3. Electrical Power Utilization
VI	Open Elective-II	1. Testing and maintenance of Electrical Equipments
		2. Advance Instrumentation
		3. Optimization Technique
	Professional Elective-II	1. Electrical Installation and Design
		2. Electrical Machine Design
		3. Electric Drives and their control
VII	Open Elective-III	1. Energy Management and Audit
		2. Industrial Economics and Entrepreneurship
		3. Electric and Hybrid Vehicles
	Professional Elective-III	1. Advanced Power Electronics
		2. HV Engineering
		3. Integrated Renewable Energy Systems
	Professional Elective-IV	1. Fuzzy Logic and Neural Networks
		2. Advanced Electrical Power Systems
		3. Flexible AC Transmission System
	Professional Elective-V	1. Introduction to Artificial Intelligence
		2. Digital signal processing and its applications
		3. Introduction to Smart Grid
VIII	Professional Elective-VI	1. SWAYAM – https://swayam.gov.in
		NPTEL – **https://onlinecourses.nptel.ac.in/**
		2. MOOC – https://mooc.org
		3. Power semiconductor drives
		4. Electrical Distribution System
	Professional Elective-VII	1. SWAYAM – https://swayam.gov.in
		2. NPTEL – **https://onlinecourses.nptel.ac.in/**
		3. MOOC – https://mooc.org
		4. EHVAC/DC transmission System
		5. Power Quality

III Semester B.E. (Electrical Engineering)
ELECTRICAL ENGINEERING MATHEMATICS
Total Credit- 04
Subject Code:-BEEE3O1T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial -01 Hours/Week	Duration of University Exam:- 3 Hours

Course Objectives

Students will be able to –

- understand the calculus, matrix algebra, basics of various transformation methods, mathematical modeling and probability analysis
- apply the mathematical analysis to electrical circuits and systems

Course Outcomes:

After Completing the Course, Students Will Be Able to –

CO1. Analysis of variations using different methods, Solution of Partial Differential Equations of First Order First Degree, Numerical Solution to Ordinary differential equations.

CO2. Formulation and solving the systems with complex variables.

CO3. Application of Differential equations and Laplace Transform for mathematical model formulation of the physical systems, Understanding the concept of transfer function.

CO4. Understanding of linear and orthogonal transformation, Solution to second order differential equations

CO5. Understanding the concepts of Stochastic analysis and its application

Unit – I: Calculus Of Variations And Partial Differential Equations (13 Hrs)

Functions, Maxima and minima of functions, Euler's equation (statement only), Functions dependent on First & Second order derivatives, Isoperimetric Problems, Solution of Boundary Value problems by Rayleigh-Ritz method.Partial Differential Equations of First Order First Degree i.e. Lagrange's form, Linear Homogeneous Equations of higher order with constant coefficients. Method of separations of variables, Simple Applications of Laplace Transform to solve Partial Differential Equations (One dimensional only). Numerical solution of ordinary differential equations :Taylor's series method, Runge-Kutta 4th order method, Euler's modified method. Milne, s Predictor- Corrector method, Solution Of Second Order Differential Equations and Simultaneous Differential Equations by Runge- Kutta method.

Unit- II: Functions Of Complex Variable (10 Hrs)

Analytic function, Cauchy- Riemann Conditions, Harmonic Functions (excluding orthogonal system), Milne-Thomson Method, Cauchy Integral Theorem & Integral Formula (Statement only), Taylor's & Laurent's series (Statement only), Zeros and Singularities of Analytic function, Residue Theorem (Statement only), Contour integration (Evaluation of real definite integral around unit circle and semi-circle).

Unit–III : Mathematical Modeling And Transfer Function (09 Hrs)

Mathematical Modeling of physical systems and Differential equations (Mechanical systems, basic translational and rotational systems, basic R-L-C series and parallel circuits), Concept of transfer function, Transfer function for elementary R-L-C circuits, Elementary block diagram single input single output closed loop system and its reduction. Introduction to various transform methods, Laplace transform of step, ramp & parabolic signals, Time response of first order systems and second order systems for unit step input, Concept of characteristicequation q(s) = 0 vs time response

Unit –IV: Matrices (10 Hrs)

Linear and Orthogonal Transformations, Linear dependence of vectors, Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem [without proof], Reduction to Diagonal form, Reduction of Quadratic form to Canonical form by Orthogonal transformation, Sylvester‟s theorem [without proof], Solution of Second Order Linear Differential Equation with Constant Coefficients by Matrix method.

Unit – V: Theory Of Probability (07 Hrs)

Axioms of Probability, Conditional Probability, Baye‟s Rule, Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Mathematical Expectation, Functions of random variable, Variance & Standard Deviation, Moments, Moment generating function, Measures of central tendency and Dispersion, Skewness and Kurtosis. Binomial distribution, Poisson distribution, Normal distribution.

Text Books:

1. Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication
2. A Text Book of applied Mathematics, Volume II , by P.N. Wartikar & J.N.Wartikar, Poona Vidyarthi Griha Prakashan
3. Mathematics for Engineers by Chandrika Prasad
4. A text book of Engineering Mathematics by N. P. Bali & M. Goyal, Laxmi Publication.
5. Theory & Problems of Probability and Statistics by Murray R. Spiegel , Schaum Series, McGraw Hills

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreysizig, 8th Edition, Wiley India
2. Introductory methods of Numerical Analysis, by S.S. Sastry, PHI
3. Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville
4. A text book of Engineering Mathematics by N. P. Bali & M. Goyal, LaxmiPublication.
5. Control Systems Engineering by Nagrath & Gopal, New Age InternationalPublishers

III Semester B.E. (Electrical Engineering)

NETWORK ANALYSIS

Total Credit- 04

Subject Code:-BEEE3O2T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hours/Week	Duration of University Exam:- 3 Hours
Practical:- 02 Hours/ Week	

Course Objectives

Students will be able to –

- To provide various methods of analysis of electric networks under transient and steady state conditions.
- To provide concrete foundation needed to learn future professional courses.

Course Outcomes:

After studying the course, the students will be able to demonstrate the ability to

CO1. Apply mesh current and node voltage methods to analyze electrical circuits.

CO2. Apply network theorems for the analysis of networks.

CO3. Obtain transient and steady-state responses of electrical circuits.

CO4. Synthesize waveforms and apply Laplace transforms to analyze networks.

CO5. Evaluate different Network Functions and understand two port network behavior

Unit –I: Sources, Mesh Analysis, Node voltage analysis (07 Hrs)

Voltage and Current sources, source transformation, mesh basis equilibrium approach for simple networks of having mutual coupling, Node voltage analysis of networks, concept of duality.

Unit –II: Network Theorems (07 Hrs)

Thevenin's, Norton's, Maximum Power transfer, Reciprocity theorems as applied to D C. & A. C. circuits with independent and dependent sources.

Unit –III: Solution of First and Second Order Networks (07 Hrs)

Solution of first and second order differential equations of different combinations of series and parallel RLC networks. Initial and final conditions in network elements, free and forced response, time constants.

Unit –IV: Electric Circuit Analysis using Laplace Transforms (07 Hrs)

Review of Laplace transform, waveform synthesis, Analysis of electrical circuits using Laplace transform for standard inputs, analysis of networks with and without initial conditions using Laplace transforms.

Unit –V: Two port networks and Network functions (08 Hrs)

Two port networks, relationship between two port variables, driving point and transfer functions, properties, concept of complex frequency, Poles and zeros.

Two port network parameters: Impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnection of two port networks.

Text Books:

1. Van Valkenburg, "Network Analysis", Third Edition, 2009, Prentice Hall of India
2. Sudhakar, A, Shyammohan, "Circuits and Networks", Third Edition, 2006, Tata McGraw-Hill.
3. D. Roy Choudhary, "Networks and Systems", New Age International Publishers, 2nd Edition, 2012
4. Kelkar and Pandit, "Linear Network Theory", Pratibha Publications.

Reference Books:

1. Mahmood Nahvi, Joseph A Edminister, "Schaum's outline of Electric Circuits", 6th Edition, Tata McGraw-Hill, 6th Edition, 2013
2. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
3. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
4. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
5. K. Sureshkumar, "Electric Circuits & Network", Pearson Publication
6. Del Toro, "Electrical circuit", Prentice Hall

III Semester B.E. (Electrical Engineering)

NETWORK ANALYSIS (Practical)

Total Credit- 02

Subject Code:-BEEE3O2P

Teaching Scheme	**Examination Scheme**
Practical:- 02 Hours/ Week	Pr (U)= 25Pr(I)=25

Course Objectives

Students will be able to –

- To choose appropriate measuring instruments along with proper rating of wires to carry out various experiments
- To provide hands on experience of substantiating and verifying the theoretical concepts studied in Network Analysis.

Hands on Experiments related to the course contents of Network Analysis (minimum 10 experiments).

III Semester B.E. (Electrical Engineering)

ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Total Credit- 04

Subject Code:-BEEE3O3T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hours/Week	Duration of University Exam:- 3 Hours
Practical:- 02 Hours/ Week	

Course Objectives

Students will be able to –

- Understand the characteristics and operation of different electrical instrument used for measurement of electrical and non-electrical parameters
- Measurement of active and passive components of electrical circuit using various bridges and transducers.

Course Outcomes:

After studying the course, the students have understood:

- **CO1.** Various aspects of measurement and instrumentation.
- **CO2.** Different active and passive components measurement methods.
- **CO3.** Power and Energy measurement.
- **CO4.** Instrument Transformers.
- **CO5.** Aspects and types of transducers.

Unit I: Generalized Measuring Instruments: (08Hrs.)

Classification of Instruments, forces acting in Indicating instruments, Moving iron, PMMC type instruments, Static and Dynamic characteristics and performance of instruments, Errors in measurements, loading effect of instruments.

Unit II: Measurement of RLC Elements (08Hrs.)

Measurement of Resistance: classification, Measurement of medium resistance :- Wheatstone Bridge. Low resistance: - Kelvin's Double Bridge. High resistance:- Ohm meter, Megger & loss of charge method.

Measurement of inductance using Maxwell's inductance-capacitance bridge, Measurement of Capacitance using Schering bridge.

Unit III: Measurement of Power and Energy (08Hrs.)

True RMS Measurement, Blondel's Theorem, Measurement of active, reactive and apparent power in polyphase circuits. Electrodynamometer type wattmeter, Measurement of Energy in single and polyphase circuits, Induction type Energy meter, digital energy meters.

Special Instruments: Power factor meter, frequency meter, synchronoscope

Unit IV: Instrument Transformers (08Hrs.)

General theory of Instrument transformers, various ratios, burden, characteristics and Phasor diagram of Current transformer and potential transformers & extension of range using C.T. & P.T., errors in instrument transformers.

Unit V: (Part A) Analog Transducer (06Hrs.)

Classification of Transducer, Measurement of Electric quantities through Resistive, inductive, capacitive effects, Measurement of Non-electric quantities like Displacement, pressure, Torque, Flow.

Special Instruments: load cell, seismic instruments, Anemometer, Pyrometer.

(Part B) Digital Measuring Instruments (06 Hrs.)

Definition of Digital transducer, Classification, Introduction to digital measurement, Measurement of Electric quantities like Digital Encoder, Hall effect sensor,

Latest trends of measurement in power sector like SCADA, EMS.

Text Books:

1. A.K. Sawhney, "A Course in Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Sons, 2015
2. E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A.H. Wheeler & Co. India.
3. C.S. Rangan, G.R. Sharma, V.A.V. Mani, "Instrumentation, Devices and Systems", TMH, 2nd edition

Reference Books:

1. Ernest O.Doebelin, "Measurement Systems Application and Design, International Student Edition", McGraw Hill Book Company, 1998.
2. Alan S. Morris, Reza Langari, "Measurement and Instrumentation: Theory and application", Academic Press, 2012
3. Rajendra Prashad, "Electrical Measurement &Measuring Instrument" Khanna Publisher.
4. J.B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons
5. H.S. Kalsi, "Electronic Instrumentation", 6th Edition McGraw Hill
6. W.D. Cooper, "Electronic Instrument & Measurement Technique" Prentice Hall International.
7. Dr. V. Kamaraju "Electrical Power Distribution System" McGraw Hill Education (1 July 2017)

III Semester B.E. (Electrical Engineering)

ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Total Credit- 01

Subject Code:-BEEE3O3P

Teaching Scheme	**Examination Scheme**
Practical:- 02 Hours/ Week	Pr (U)= 25Pr(I)=25

List of Experiments:(Any 10)

1. Measurement of low resistance by Kelvin's Double Bridge.
2. Measurement of medium resistance by Ammeter Voltmeter Method.
3. Measurement of high resistance by Loss of Charge Method.
4. Measurement of Capacitance by schering bridge.
5. Measurement of inductance by Maxwell's bridge.
6. Measurement of three phase power by Two Wattmeter method.
7. Study of Differential and Additive connection of current transformer.
8. Reactive power measurement by one wattmeter method.
9. Calibration of energy meter.
10. Study of Differential and Additive connection of current transformer.
11. Measurement of energy using different CTs and PTs.
12. Determination of polarities and ratio of various CTs and PTs.
13. To study and plot the characteristics of LVDT.
14. To study and plot the characteristics of Stain gauge.
15. To analyse the characteristics of the Piezo electric sensor.
16. Study the performance and characteristics of Hall Effect voltage sensor.

Activity:

1. To assemble the components of a given electrical circuit. (Resistor, ammeter, voltmeter , battery, one way key, rheostat, connecting wires.
2. To measure the resistance and impedance of an inductor with or without iron core.
3. To measure resistance, voltage (dc/ac), current (dc) and check continuity of a given circuit using a multimeter.
4. To assemble a household circuit comprising of three bulbs, three (on/off) switches, a fuse and a power source.
5. To study the variation in potential drop with length of a wire for a steady current.
6. Measurement of Earth Resistance.
7. Calculation of residential and commercial energy bill.

III Semester B.E. (Electrical Engineering)

ANALOG DEVICES AND CIRCUITS

Total Credit- 04

Subject Code:-BEEE3O4T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hours/Week	Duration of University Exam:- 3 Hours
Practical:- 02 Hours/ Week	

Course Objectives

Students will be able to –

- To provide basic knowledge and applications of diodes, transistors and MOSFETs.
- To provide basic functioning of OP-AMPs and applications of OP-AMPs.

Course Outcomes:

After studying the course, the students will be able to demonstrate the ability to

CO1. Design and Analyze rectifier circuits

CO2. Understand the characteristics and use of a transistor as amplifiers

CO3. Apply the knowledge of transistor for the analysis of power amplifiers and oscillators.

CO4. Understand OP-AMPs.

CO5. Analyze and utilize OP-AMPs

Unit I: Diode Circuits: (07 Hrs.)

P-N junction diode, operation and characteristics; half-wave and full-wave rectifiers, Filters, Ripple factor, characteristics and applications of Zener diodes, photo diodes, LED, Schottkey Diodes, voltage regulators

Unit II: Transistor Circuits (08 Hrs.)

Operation and characteristics of a BJT. BJT as a switch. BJT as an amplifier: Biasing circuits, small-signal analysis of CE, CB and CC amplifiers, high-frequency analysis. Power Transistors, Transistor as a switch. Field effect transistors and MOSFETs- Principle of operation and characteristics, biasing arrangements

Unit III: Power amplifiers (08 Hrs.)

Classification as A, B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications

Oscillators- Barkhausen's criterion, RC and Crystal oscillators

Unit IV: Power amplifiers (08 Hrs.)

Differential amplifier circuits and their stages, current source, biasing, level Shifting techniques, Common mode and differential mode gain, Impedance of different stages.

Unit V: Applications of Op-Amp (08 Hrs.)

Inverting and non-inverting amplifier, integrator, active filter, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Hysteresis Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier.

Study of linear ICs: LM741, LM555, LM 7805

Text books:

1. Millman and Halkias, "Electronic Devices and Circuits", McGraw Hill.
2. Millman and Halkias, "Integrated Electronics", McGraw Hill
3. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
4. R. Gaikwad, "Operational Amplifiers and applications"
5. Linear ICs Manual I, II, III, National Semiconductors

Reference Books:

1. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
2. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
3. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

III Semester B.E. (Electrical Engineering)

ANALOG DEVICES AND CIRCUITS

Total Credit- 01

Subject Code:-BEEE3O4P

Teaching Scheme	**Examination Scheme**
Practical:- 02 Hours/ Week	Pr (U)= 25Pr(I)=25

10 Experiments based on above syllabus.

III Semester B.E. (Electrical Engineering)
RENEWABLE ENERGY STUDIES
Total Credit- 04
Subject Code:-BEEE3O5T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hours/Week	Duration of University Exam:- 3 Hours
Practical:-	

Course Objectives

Students will be able to –

- Demonstrate understanding of the different types of renewable energy technologies that are currently available, and how they are used to provide energy.
- Identify strengths and limitations associated with the different renewable energy technologies.
- Identify the current major uses of energy (i.e., in agriculture, manufacturing, residential, etc.).

Course Outcomes:

After studying the course, the students will be able to demonstrate the ability to

CO1. Memorize the fundamental of solar radiation geometry
CO2. Identify and analyse the process of power generation through solar photovoltaic
CO3. Highlighting the various applications of Solar Energy.
CO4. Outline the site requirement criteria for wind farm & compare different types of wind generators.
CO5. Identifying non-conventional Energy sources such as Geothermal, MHD, Biomass, Fuel cell, Tidal, Ocean for generating Electricity.

Unit I- Solar Radiation & its Measurement (06 Hrs)

Solar Radiation & its Measurement: Solar Constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces.

Unit 2 – Solar Photovoltaic power generation (10 Hrs)

Solar Photovoltaic power generation: Physics of solar cells, Characteristic of solar cell, series and parallel connection, types of solar cell, module manufacturing, partial shading, bypass and blocking diode, load calculation, different panel calculations and selection (Monocrystalline, Polycrystalline etc), Calculation of Solar rooftop setup (rating): stand alone PV system with battery and grid connected PV system with Net Metering, Introduction to MPPT.

Unit-3 Application of Solar Energy (07 Hrs)

Application of Solar Energy: Solar water heating, space heating, space cooling, solar thermal heat conversion, Solar Cooking, Solar pumping, Solar Water pumping for agriculture purposes, Calculation of solar setup required in solar water pumping, Solar Green Houses, Hydrogen production from Solar Energy.

Unit – 4 Wind Energy (10 Hrs)

Basic principles of wind energy conversion, wind energy conversion system, wind data & energy estimation, site selection consideration, basic components of wind energy conversion system (WECS), classification of WEC system, generating system, energy storage, application of wind energy. Stand-Alone and Grid Connected Wind-Electrical Power System

Unit- 5 Other Nonconventional Energy Source (07 Hrs)

Brief Introduction to operating principles only: Small scale hydro electric power generation, Energy from Bio –Mass, Geothermal Energy, MHD power generation, Fuel cell, Energy from Ocean, Ocean thermal electric conversion (OTEC), Claude & Anderson cycles, Hybrid cycle, Energy from Tides ,Estimation of Energy & Power in simple single basin ,Tidal system

Text Books:

1. Non Conventional Energy Sources G.D. Rai, Khanna publishers
2. Non Conventional Energy Resources B. H. Khan 2nd , The McGraw Hill Companies
3. Solar Energy: Principles of thermal collection and storage, S. P. Sukhatme 2nd edition, Tata McGraw Hill Publishing Company Ltd.
4. Solar Photovoltaics: Fundamental, Technologies and Applications, Chetan Singh Solanki , 3rd Edition, PHI Learning Pvt. Ltd.
5. Non-Conventional Energy Sources and Utilization, R.K. Rajput, S. Chand Publications.
6. Non-Conventional Energy Resources, D S Chauhan, S K Srivastava, New Age International Publishers

Reference Books:

1. Fundamentals of Renewable Energy Processes, Aldo Vieira da Rosa, Juan Carlos Ordóñez, Fourth Edition, Elsevier Academic Press
2. Wind and Solar Power Systems: Design, Analysis, and Operation, Mukund R. Patel and Omid Beik, THIRD EDITION CRC PRESS(TAYLOR & FRANCIS)
3. Renewable & Efficient Electric Power Systems, Gilbert Masters John,, Wiley and son's publications.
4. Solar Energy , Robert Foster, Majid Ghassemi and Alma Cota, CRC Press
5. Renewable Energy Systems, David M. Buchla, Thomas E. Kissell, Thomas L Floyd, 1st edition, Pearson Publication
6. Ocean Energy: Tide and Tidal Power, R. H. Charlier, Charles W. Finkl**, SPRINGER**

Reference Links:

- **http://www.nptel.iitm.ac.in/**
- **www.ocw.mit.edu**

III Semester B.E. (Electrical Engineering)

INTRODUCTION TO PYTHON PROGRAMMING

Total Credit- 01

Subject Code:-BEEE3O6T

Teaching Scheme	**Examination Scheme**
Theory-01 Hours/Week	Th (U)= 35 Th(I)=15
Tutorial/ Activity -	Duration of University Exam:- 2 Hours
Practical:- 02 Hours/ Week	

Course Objectives

Students will be able to –

- To understand why Python is a useful scripting language for developers
- To learn how to design and program Python applications
- To learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to identify Python object types.

Course Outcomes:

After studying the course, the students will be able to

CO1. Identify different operators and execute different programs using loops

CO2. Analyse Strings, List, Tuples, Dictionary and Sets

CO3. Illustrate functions and utilise Date Time in programming language.

UnitI : Introduction To Python (04 Hrs.)

Introduction To Python, Operators, Identifiers, Variables, Relational Operators, User Input And Output

Unit II: Data Types Of Python (05 Hrs.)

Strings – Indexing, Slicing, Methods For Strings – Isupper, Upper, Lower, Find, Swapcase Etc, List – Indexing, Slicing, Copy (Deep And Shallow), Methods For List – len, append, extend, sort ,insert, delete, pop, max, min, sum, count etc, List Comprehensions, TUPLES – discard, remove and pop, DICTIONARY – creation method, lists of tuple in dictionary, list of list in dictionary, len and del in dictionary, Deep and shallow copy in dictionary, Methods for dictionary, dictionary comprehension, SETS

Unit III : Functions, Loops And Modules (05 Hrs.)

Control Statement - Conditional Statement Like If, Else, Elif , Loop- While, For, Loop Control Statement - Break, Continue, Pass, Introduction To Functions, Logic With Python Functions, Keyword Arguments, Args And Kwargs, Return Statement, Lambda, Map And Filter, Import Module , Datetime With Python And Exception Handling

Time Class,Date Time Class, Date From Time Stamp, Time Delta, String Format Time, String Past Time, Handling Timezone In Python, Exception Handling- Try, Except, Finally

Text Books

1. Programming And Problem Solving With Python by Ashok Namdev Kamthane and Amit Ashok Kamthane, McGraw Hill
2. Let Us Python, Yashwant Kanetkar and Aditya Kanetkar, 2nd Edition, bpb Press
3. Python Crash Course, 2Nd Edition: A Hands-On, Project-Based Introduction To Programming, Eric Matthes (No Starch Press, 2016)
4. Zero To Mastery In Python Programming, Best Python Book For Beginners, by RAKESH K. YADAV , SRINIVAS ARUKONDA, MONU SINGH, VEI Publishers
5. Core Python Programming - Covers Fundamentals to Advanced Topics Like OOPS, Exceptions, Data Structures, Files, Threads, Networking, GUI, DB Connectivity and Data Science Second, Rao R. Nageswara, Dreamtech Press
6. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford Higher Education

Reference Book

1. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
2. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
3. Head First Python 2e: A Brain-Friendly Guide By Paul Barry, Oreilly Publication

III Semester B.E. (Electrical Engineering)

INTRODUCTION TO PYTHON PROGRAMMING

Total Credit- 01

Subject Code:-BEEE3O6P

Teaching Scheme	**Examination Scheme**
Practical:- 02 Hours/ Week	Pr(U)= 25Pr(I)=15

List of Practical's (Minimum 10 experiments should be performed)

1. Print only the words that starts with letter 's' in the following statement –
2. St- 'print only the word that starts with s in this sentence'
3. Print Every word from the below sentence which has even number of letters –
4. St- 'print only the word that starts with s in this sentence'
4. write a program that prints the integer from 1 to 100, but for multiples of 3 print 'FIZZ' instead of number and for multiples of five print 'BUZZ'. For numbers which are multiples of both 3 and 5 print 'FIZZBUZZ'
5. Write a program using function to check who is employee of the month.
6. Write a program to mimic the carnival game 'Three Cup Montee'
7. write a program that returns the lesser of two given numbers if both numbers are even, but returns the greater if one or both numbers are odd.
8. Write a python function that accepts a string and calculate the number of upper case letters and lower case letters.
9. Write a python function that takes a list and return anew list with unique elements of the first list. For example,
5. Sample List =[1,1,1,2,2,3,3,4]
6. Unique List = [1,2,3,4]
10. Write a python function to multiply all the numbers in the list
11. Write a program for validating the user input
12. Using Object oriented Programming, write a program for opening a Bank account, deposit of money and withdrawal of money. Also generate a 4 digit unique code for each transaction.
13. Write a program to print next 5 days starting from today
14. Write a function that asks for an integer and prints square of it. Use a while loop with a try, except, else block to account for incorrect inputs.

IV Semester B.E. (Electrical Engineering)
SIGNAL AND SYSTEMS
Total Credit- 04
Subject Code:- BEEE401T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hous/Week	Duration of University Exam:-3 Hours

Course Objectives

Students will be able to –

- Understand the various methods of analysis for continuous time and discrete time systems in time domain and frequency domain
- Apply various transformation analysis to electrical signals

Course Outcomes:

After studying the course, the students will be able to

CO1. Understanding the basics of signal space theory
CO2. Understanding the concepts of state space representation
CO3. Understand convolution sum of two signals
CO4. Apply Fourier and Laplace transforms, understand the duality Apply DFT, DTFT and z-transform
CO5. Understand the concept of sampling and reconstruction

UNIT I: Introduction to Signals and Systems (06 Hrs)

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additively and homogeneity, shift-invariance, causality, stability, realizability. Examples.

UNIT II: Behavior of continuous and discrete-time LTI systems (08 Hrs)

Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT III Convolution (04 Hrs)

Convolution Sum, Convolution Integral and Their Evaluation, Time Domain Representation and Analysis of LTI Systems Based on Convolution and Differential Equations.

UNIT IV Time and Frequency Domain Transformations (17 Hrs)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and study of system behavior, The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT V: Sampling and Reconstruction (07 Hrs)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction, ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory, filtering, feedback control systems.

Text Books:

1. Oppenheim A.V., Willsky A.S. and Young I.T., “Signals and Systems”, Second Edition, 1997, Prentice Hall.
2. Simon Haykin and Barry Van Veen, “Signals and Systems”, Second Edition, Wiley International.

Reference Books:

1. R.F. Ziemer, W.H Tranter and J.D.R.Fannin, “Signals and Systems - Continuous and Discrete”, Forth Edition Prentice Hall.
2. M. J. Roberts, “Signals and Systems”, 2003, Tata McGraw-Hill

IV Semester B.E. (Electrical Engineering)

DIGITAL ELECTRONICS

Total Credit- 04

Subject Code:- BEEE402T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hous/Week	Duration of University Exam:-3 Hours
Practical- 02 Hours/week	

Course Objectives

Students will be able to –

- To provide basic knowledge and applications of logic gates and logic families.
- To provide basic understanding of Analog to digital and digital to analog converters.

Course Outcomes:

After studying the course, the students will be able to demonstrate the ability to

CO1. Understand number system, logic gates and logic families.
CO2. Design and implement combinational digital circuits.
CO3. Design and implement sequential logic circuits.
CO4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
CO5. Understand memories and PLDs to implement given logic.

UNIT I: Fundamentals of Digital Systems and Logic Families (07 Hrs)

Number systems-binary, signed binary, binary arithmetic, one's and two's complements arithmetic, octal and hexadecimal number system , codes, error detecting and correcting codes, Digital Signals, basic digital circuits, NAND and NOR operations, Exclusive – OR and Exclusive NOR operations, Boolean algebra, Examples of IC gates, Digital logic families, TTL and Schottkty TTL and CMOS logic, interfacing CMOS and TTL, Tri-State logic.

UNIT II: Combinational Digital Circuits (07 Hrs)

Standard representation for logic functions, K-map representation (up to 4 variables), and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, use in combinational logic design, Adders, Subtractors, BCD arithmetic, carry, Arithmetic logic unit (ALU), popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.

UNIT III: Sequential circuits and systems (07 Hrs)

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K flip flop, T and D types flip-flops, excitation table of flip flop, conversion of flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial

converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT IV: A/D and D/A Converters (07 Hrs):

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit.

Analog to digital converters: quantization and encoding, parallel comparator, A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

UNIT V: Semiconductor memories (08 Hrs).

Memory organization and operation, expanding memory size, classification and characteristics of memories, Types of Memory commonly used memory chips.

Programmable Logic Devices: ROM as Programmable logic devices (PLD), Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA)

Text Books /References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. H.Taub, "Digital Integrated Electronics" McGraw Hill
4. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
5. Herbert Taub, Donald LSchilling "Digital Integrated Electronics", McGraw Hill, 1977
6. Thomas C Bartee, "Digital Computer Fundamentals",McGraw Hill,1985.

IV Semester B.E. (Electrical Engineering)

DIGITAL ELECTRONICS

Total Credit- 04

Subject Code:- BEEE402P

Teaching Scheme	**Examination Scheme**
Practical- 02 Hours/week	Pr (U)= 25Pr(I)=25

Experiments based on the above syllabus with at least one experiment from each unit.

IV Semester B.E. (Electrical Engineering)

ELECTRICAL MACHINES-I

Total Credit- 04

Subject Code:- BEEE403T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -01 Hous/Week	Duration of University Exam:-3 Hours
Practical- 02 Hours/week	

Course Objectives

Students will be able to –

- The Basic Principle of Transfer of Electrical Power Operation and Construction of Single Phase and Three Phase Transformer with Phasor diagram and Connection.
- The Construction, Principle and Applications of D.C.Machines.
- The Construction, Principle and Applications of Three Phase Induction Motor.
- The Construction, Principle and Applications of Three Phase Synchronous Machines.
- The Construction, Principle and Applications of Single Phase Machines and Special Machines.

Course Outcomes:

After Completing the Course, Students Will Be Able to –

CO1. Determine Equivalent Circuit parameter, Efficiency and Regulation of Single Phase Transformer and to Explain the Phasor groups of Three Phase Transformer.

CO2. Analyze different characteristics of D. C. Motor and Speed Control of D.C. Motor.

CO3. Explain different types of Three Phase Induction Motor and Analyze the characteristics at different Value of Slip.

CO4. Know Voltage Regulation of Three Phase Synchronous Generator and Behavior of Synchronous Motor with Different Excitations

CO5. Understand Single Phase Machines and Special Machines.

Unit-I Single Phase Transformer (12-Hrs)

Revision of Single Phase Transformer, Phasor Diagram Under Different Load Conditions, Losses, Equivalent Circuit, Open Circuit and Short Circuit Test, Voltage Regulation, Efficiency, Condition of Maximum Efficiency, All Day Efficiency, Polarity Test. Single phase Auto-Transformer, Working, Merits and Demerits. Applications.

Three Phase Transformer: -Principle and Operation, Connection and Phasor Groups, Polarity Test, Open Circuit and Short Circuit Test, Conditions of Parallel Operation.

Unit II D.C. Machines (08-Hrs)

Basic Principle and Operation of D.C. Motor and D.C. Generator, Emf Equation and Torque equation, Types of D.C. Machines, Characteristics and Speed Control of D.C. Shunt and D.C. Series Motor, Losses and Efficiency of D.C. Motor. Necessity of Starter and Constructional Details of Three Point Starter. Armature Reaction in D. C. Machines. Applications.

Unit III Three Phase Induction Motor (08-Hrs)

Construction Details, Types, Principle, Production of Torque, Torque Equation and Condition of Maximum and Starting Torque, Losses and Efficiency, Torque-Slip Characteristics, Behavior for Different values of Slip. No Load Test and Blocked Rotor Test. Starting methods of Three Phase Induction Motor. Applications.

Unit IV Synchronous Machines (08-Hrs)

Three Phase Synchronous Generator : -Introduction, Constructional features of Salient Pole and Cylindrical Pole Rotor Machines, Introduction to Armature Winding and Field Winding, Winding Factors and EMF Equation, Armature Reaction, Phasor Diagram Under Load Condition, Regulation and Synchronous Impedance Method to Find Voltage Regulation.

Three Phase Synchronous Motor: - Construction and Principle, Starting of Synchronous Motor, Motor on Load, Effect of Changing Field Excitation at Constant Load, V and Inverted-V Curves.

Applications.

Unit V Single Phase Machines (07-Hrs)

Single Phase Induction Motor :-

Principle and Operation, Double Field Revolving Theory. Principle and Working of Shaded Pole Induction Motor , Split Phase Induction Motor and Capacitor Start Capacitor Run Motor. Applications.

Principle, Working And Applications Of Special Machines:-

Universal Motor, Hysteresis Motor, Brushless D. C. Motor, A.C. Series Motor.

TEXT BOOKS:-

1. I. J. Nagrath , D.P. Kothari, “Elecrtcal Machines,”, Tata McGraw- Hill Publishing Company Ltd.
2. P.S.Bhimbra,”Electrical Machinery”, Khanna Publishers.
3. P.K. Mukherjee, S. Chakrabvorty, “ Electrical Machines”, Dhanpat Rai Publications.
4. P.S. Bhimbra , “Generalized Theory in Electrical Machines”, Khanna Publishers.
5. D C Kulshreshtha, “Basic Electrical Engineering,” The McGraw Hill Higher Education Private Limited, New Delhi.

6. S.G.Tarnekar, P.P. Kharbanda, S.B.Bodkhe, S.D. Naik , " Laboratory Courses in Electrical Engineering," S. Chand & Company Ltd., New Delhi.
7. Use of ICT Tools.

REFERENCE BOOKS :-

1. M.G.Say, " Performance and Design of A.C. Machines," CBS Publishers and Distributors Pvt. Ltd.
2. A.F. Fitzgerlad, Charles Kingdey, Jr. Stephan D. Umans, "Electrical Machinery", Fifth Edition in SI Units, McGraw Hill Book Company.
3. D.P. Kothari, B.S.Umre, "Laboratory Manual for Electrical Machines," Second Edition , I.K. International Publishing House Pvt.Ltd., New Delhi.

IV Semester B.E. (Electrical Engineering)

ELECTRICAL MACHINES-I

Total Credit- 04

Subject Code:- BEEE403P

Teaching Scheme	**Examination Scheme**
Practical- 02 Hours/week	Pr (U)= 25 Pr (I)=25

10 EXPERIMENTS BASED ON ABOVE SYLLABUS.

IV Semester B.E. (Electrical Engineering)

POWER SYSTEM

Total Credit- 03

Subject Code:- BEEE404T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity -	Duration of University Exam:-3 Hours

Course Objectives

Students will develop the ability

- To model and represent the power system components, understand and calculate the transmission line parameter, evaluate its performance, understand the method of load flowanalysis and the concept of voltage stability.

Course Outcomes:

After Completing the Course, Students Will Be Able to –

CO1. Understand the basic structure of powersystem , smart grid and microgrid.
CO2. Model and represent the power systemcomponents in its per unit value.
CO3. Learn the parameters of transmission linesand cables.
CO4. Evaluate the performance of transmissionlines.
CO5. Acquaint with the method of load flowanalysis and the concept of voltage stability.

UNIT- I: Evolution of Structure of Power Systems (08Hrs)

Structure of power systems, brief exposure to generation, transmission and distribution aspects, Present-Day Scenario, Introduction to Smart Grids and Micro-grids, their components, Standardization of transmission voltages, Overhead and Underground transmission system, EHVAC verses HVDC transmission, HVDC Components, distribution connection scheme (radial, ring main and interconnected), Feeders and distributors, Substation and its equipments.

UNIT- II: Per Unit Representation (06Hrs)

Representation of power system elements, models and parameters of generator, transformer and transmission lines and load, voltage and frequency dependence of loads, single line impedance diagram, advantages of per unit representation.

UNIT-III: Overhead Transmission Lines and Cables (10Hrs)

Components of overhead lines, choice of conductors, Skin effect, Proximity effect, Corona, Transposition of conductors, Bundled conductor, Types of insulators , string efficiency, Method to improve string efficiency, Derivation for Inductance of a single phase line, concept of self GMD and mutual GMD, Derivation for Capacitance of a single phase line, Insulated Cables, Dielectric stress in single core cables, Grading of cables, XLPE cables.

UNIT-IV: Performance of Transmission line (08Hrs)

Classification of transmission line (short, medium (nominal T and nominal Π) and long), Characteristics (voltage regulation and efficiency) of transmission lines, determination of generalised (A,B,C,D) constants for transmission line, Ferranti effect, Surge Impedance Loading, Series and Shunt Compensation of transmission lines (using capacitors only) .

UNIT-V: Load Flow Studies (08Hrs)

Introduction to load flow studies, Classification of buses , Formation of bus admittance matrix, Static load flow equations, Gauss Seidel and Newton-Raphson method for solution (Numerical is not expected), Introduction of frequency and voltage as system state indicators, Concept of Voltage Stability, P-V and V-Q curves, Methods to improve voltage stability.

Text Book

1. I. J. Nagrath, D. P. Kothari, Power System Engineering, Tata McGraw-Hill publications, 2008
2. Ashfaq Husain, Electrical Power System, CBS Publication, 5th Edition
3. C. L. Wadhwa, Electrical Power Systems, New Age International Publiser, 6th Edition
4. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand Publication, 2008

Reference Books:

1. W.D. Stevenson, Elements of power system analysis, McGraw-Hill publications, 3rd Edition
2. O. I. Elgerd, Electric Energy Systems Theory: An Introduction, McGraw-Hill publications, 2ndEdition
3. Hadi Saadat, Power System Analysis , TMH , 2002
4. James A Momoh, Smart Grid : Fundamentals of Design and Analysis, Wiley 2012
5. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”,Wiley 2012

IV Semester B.E. (Electrical Engineering)

ELECTROMAGNETIC FIELDS

Total Credit- 04

Subject Code:- BEEE405T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity – 01 Hours/week	Duration of University Exam:-3 Hours

Course Objectives

Students will be able to –

- Introduce the concepts of different coordinate systems, Maxwell`s equations, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current.

Course outcomes

At the end of this course students will demonstrate the ability to

CO1. Recognize and apply the knowledge of different co-ordinate systems.

CO2. Evaluate the physical quantities of electromagnetic fields in different media and apply Gauss law.

CO3. Describe static electric fields boundary conditions, nature of dielectric materials and evaluate potential fields.

CO4. Explain steady magnetic fields, their behavior in different media, associated laws and inductance.

CO5. Understand Maxwell's equations in different forms and different media.

Unit I: Review of Vector Analysis: **(08 Hrs)**

Review of Scalars and vectors, Vector Algebra, Rectangular Co-ordinate System, Cylindrical Co-ordinate System, Spherical Co-ordinate System and transformation of Cartesian to Cylindrical, Cartesian to Spherical and vice versa.

Unit II: Coulomb's law, Electrical field intensity and electric flux density, Gauss's law, Divergence: (08 Hrs)

Coulombs Law, Electric field intensity, field due to continuous volume charge distribution, field of point charge, field of line charge, field of sheet charge, Electric Flux density, Gauss's law and Applications of Gauss's law, the divergence theorem.

Unit III: Potential of charge system , Conductors, Dielectric, Capacitance and poison's and Laplace Equations: (07 Hrs)

Definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, potential gradient. Metallic conductors, conductor properties, the

nature of dielectric materials, boundary conditions for perfect dielectric materials, Capacitance of parallel plate capacitor, capacitance of two wire line, Poisons and Laplace Equation.

Unit IV: The steady Magnetic Field and Magnetic forces: (08 Hrs)

Biot Savart's law, Ampere's Circuital law, Stoke's theorem, magnetic flux density, scalar and vector magnetic potentials. Force on moving charge, force between differential current elements, nature of magnetic material, Magnetization and permeability, Inductance and mutual inductance.

Unit V: Boundary conditions, Maxwell's equation and wave propagation: (08 Hrs)

Magnetic boundary conditions, Faraday's law, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Wave propagation, Poynting vector, skin effect.

Text books:

1. W.H. Hayt , "Engineering Electromagnetics" ,TMH Publication 2006

Reference books:

1. N.N.Rao Electromagnetic Engg. V Edition ,Prentice Hall. 2005
2. Fawwaz T.Ulaby Applied Electromagnetics, Prentice Hall. 1999
3. Krauss Electromagnetic Engg. IV Edition,Tata Mc Graw Hill. 2003
4. Shevgaonkar Electromagnetic Waves,Tata Mc Graw Hill 2002
5. Matthew, N. O. Sadiku Elements of Electromagnetics, Oxford University publication, 6th edition, 2014.

IV Semester B.E. (Electrical Engineering)

PROGRAMMING TECHNIQUES & SIMULATION

Total Credit- 03

Subject Code:- BEEE406T

Teaching Scheme	**Examination Scheme**
Theory-03 Hours/Week	Th (U)= 70 Th(I)=30
Tutorial/ Activity –	Duration of University Exam:-3 Hours
Practical:-02 Hours/ week	

Course Objectives

Students will be able to –

- The concept of programming and topics using C & C++ language and apply it in the field of engineering and technology. Similarly student will know about the MATLAB, various matrix operation and use of graphic tools for representation.

Course outcomes

At the end of this course students will be able to

CO1. Learn the basics of C programming and apply the knowledge for developing small programs including Function.

CO2. Apply the knowledge of C language for developing simple programs using variables, arrays, structures etc. for applications like searching and sorting, use of pointers & File handling functions.

CO3. Understand the basics of C++

CO4. Study the basic of MATLAB and apply fundamental knowledge for analysis of basic engineering problems.

CO5. Apply knowledge of MATLAB, Toolboxes and Simulink to solve matrix equations, plot graphs, build and analyze simple electrical circuits.

Unit-I: (08 Hrs)

Structure of C program, Data types, Variables, Input/output statements, Storage class, operators, Program control statements, Concept of function & Recursion

Unit-II: (08 Hrs)

Introduction to Arrays, Programs with Arrays, Searching (Linear & Binary), Sorting (Bubble & Selection), Introduction to Structures, Simple programs using structures, Introduction to Pointers, File Handling

Unit III:

Introduction to C++ concepts **(06 Hrs)**

Unit-IV: **(08 Hrs)**

Introduction to MATLAB Programming, Import/export data, Program and run simple scripts (M-files), Use graphics tools to display data, Conditional Statements (If-else, if-else-if), and Iterative statements (while, for loop)

Unit -V: **(10 Hrs)**

Matrix operation (Transpose, Determinant, Inverse), Plotting of graphs (Basic plot, generating waveforms) using MATLAB Programming. Programming using MATLAB functions, Introduction to Toolbox (SimPower system, Control System) and Simulink

Text Book

1. Kakade & Deshpande, A text book on Programming languages C& C++ ,DREAMTECH PRESS 2nd . Ed.
2. E. Balgurusami, Programming in ANSI- C, TATA MCGRAW-HILL Publishing Company Ltd.
3. Y. Kanetka, Let us C, 8 th BPB PUBLICATIONS
4. Jaydeep Chakravorty Introduction to MATLAB Programming, Toolbox & Simulink, Universities Press
5. Stephen Chapman, MATLAB Programming for Engineers, 4th Edition, CENGAGE Learning

Reference Book

1. B.W. Kernighan and D.M. Ritchie, C Programming languages, 2 nd EDITION PEARSON EDUCATION
2. Stormy Attaway, METLAB-A Practical introduction to programming problem Solving, Elsevier
3. Duane Hansselman Bruce Littlefield, Mastering METLAB, Pearson

IV Semester B.E. (Electrical Engineering)

PROGRAMMING TECHNIQUES & SIMULATION

Total Credit- 03

Subject Code:- BEEE406T

Teaching Scheme	**Examination Scheme**
Practical:-02 Hours/ week	Pr (U)= 25 Pr(I)=25

10 EXPERIMENTS BASED ON ABOVE SYLLABUS.