VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION W.E.F. 2018-2019 UNDER AUTONOMY

B.E 4th Year - I – SEMESTER

S.NO	Subject Reference Code	Subject	Scheme of Instructions				Scheme of Examination			
			Periods per week				Duration in Hrs	Maximum Marks		Credits
			L	T	D	P		SEE	CIE	
THEORY										
1	EE-4010	Power System Operation Control	4	1	-	-	3	70	30	4
2	EE-4020	Electrical Machine Design	4	1	-	-	3	70	30	4
3	EE-40XX	Elective - I	4	1	-	-	3	70	30	4
4	HS-4010	MEA	4	1	-	-	3	70	30	4
PRACTICALS										
5	EE-4011	MPMC Lab	-	-	-	2	3	50	25	1
6	EE-4021	Power System Lab	-	-	-	2	3	50	25	1
7	EE-4031	DSP Lab	-	-	-	2	3	50	25	1
8	EE-4041	EECS Lab	-	-	-	2	3	50	25	1
9	EE-4016	Project Seminar	-	-	-	2	-	-	25	1
		TOTAL	**16**	**4**	**-**	**10**		**480**	**245**	**21**
		Grand Total	**30**					**725**		

- **Elective – I**
  1. EE-4030: High Voltage DC Transmission
  2. EE-4040: High Voltage Engineering
  3. EE-4050: Power Quality
  4. EE-4060: Nuclear Energy
  5. ME-4150: Entrepreneurship
  6. XX-XXXX: Information Security
  7. EC-4050: Embedded Systems

*** BOS Members may kindly permit us for any modification of subject code in future.**

EE 4010 POWER SYSTEM OPERATION AND CONTROL

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide knowledge on obtaining solution for load dispatch problems. 2. To provide knowledge on modelling and analysis of power system under steady and dynamic conditions.	1. Able to identify, explain and compare the methods involved in power system calculations, applications and regulation of power system network parameters. 2. Able to interpret methods for improved utilization of existing power system. 3. Able to identify and explain methods to regulate power system parameters. 4. Able to identify failures and interruptions in power system operation.

UNIT – I:

Interconnection of power systems: Importance of interconnection of Power Systems

Economic Operation of Power System:. Input output curves – Heat rates and incremental cost curves – Equal incremental cost criterion and economic operation neglecting transmission losses. Transmission loss coefficients, Economic operation including Transmission losses.

UNIT – II:

Unit Commitment: Constraints in unit commitment-, Dynamic programming method- Lagrangian relaxation method

UNIT – III:

Load Frequency Control: Governor Characteristics – Regulation of two generators in parallel – concept of control area – incremental power balance of a control area - single area control. Flat frequency control – Flat tie line frequency control – Tie line bias control. Advantages of pool operation – Development of model for two area control. Automatic Voltage Regulator.

UNIT – IV:

Power System Stability: Definitions of Steady State Stability and Transient Stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, synchronous machine models with and without saliency, Equal area criterion, Application of equal area criterion, Swing equation, Step by step solution of Swing equation, factors effecting transient stability, auto Reclosures, mathematical formulation of voltage stability problem.

UNIT-V:

Power factor control and voltage control

Reactive Power Control: Reactive power generation by synchronous generators, FACTS Controllers-TCSC, STATCOM, UPFC.

SUGGESTED READINGS:

1. D.P.Kothari and I.J.Nagrath, Modern Power Systems Analysis, 3rd Eddition, Tata McGraw Hill, 2004
2. John, J,Grangier, William D.Stevenson Jr., Power Systems Analysis, 3rd Eddition, Tata McGraw Hill, 2003
3. C.L.Wadhwa, Electric Power Systems. 3rd Edition, New age International (P) Ltd., 2002
4. Haadi Sadat, Power Systems Analysis, Tata McGraw Hill
5. Elgard, Electrical Energy Systems Theory
6. J.Wood and B.F.Wollenberg, Power Generation, Operation and Control, 2nd ed, vol 3. New York: John Wiley & Sons Inc, 1996.
7. Chakravarthy, Power Systems Operation and Control

Modifications:

	Deletion	**Addition**	**Remarks**
Unit 1	Load flow studies		covered in 3/4 I Sem
Unit 2		Unit Commitment topic	As it is necessary
Unit 5	Automatic voltage Regulator topic		
Added reference book J.Wood and B.F.Wollenberg			

EE 4020 ELECTRICAL MACHINE DESIGN

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
To impart the fundamentals of electric machine design such that the students can apply these concepts for designing the machines**.**	**1.** Choose available materials based on the requirements of the machine design.
	2. Calculate the AT required for the air gap and teeth to suit the design requirements and design the thermal circuit for the permissible temperature rise and develop different methods to limit temperature to the maximum permissible value.
	3. Design DC machines according to the given specifications and evaluate their performance.
	4. Design AC machines, transformer,3 phase Induction machines in compliance with the given specifications and assess the performance
	5. Appraise the use of computer in machine design.

Unit I:

Electrical Engineering Materials: Design of Machines; Design Factors; Electrical Conducting materials; High conductivity Materials; Materials of high Resistivity; Super conductivity; Electrical properties of ideal insulating materials, classification of insulating materials; Insulating materials used in modern Electric Machines.

Unit II:

Magnetic Circuit : Fundamentals of Magnetic Circuits; Magnetization Curves(B-at Curves);Magnetic Leakage; Carter's coefficient Calculation of mmf in air gap; Calculation of mmf in teeth , flux density in air-gap and tooth –t , ampere turns for gap and teeth , real and apparent flux density; Types of Magnetic Leakage and magnetic leakage calculations; Calculation of magnetizing current; Field form

Thermal Circuit: Modes of heat dissipation; Heating time constant; Cooling Time constant; Rating of Machine; Selection of motor power ratings, Cooling of Rotating machines, Methods of cooling; Cooling system; Enclosures for Rotating Electrical Machines; Induced and Forced Ventilation, radial And Axial Ventilation; quantity of cooling medium; Types of Duties and Ratings, Methods used for determination of motor rating for variable load

Unit III

DC Machine Design: Design output equation; Choice of Average gap density, choice of ampere conductor per meter; Interdependence of specific magnetic and electric loading; selection of number of poles, choice of armature core length, Armature diameter, length of air gap, armature design, design of shunt field winding.

Unit IV

AC Machine Design:

Transformer Design: Output Equation- volt per turn- ratio of iron loss to copper loss, relation between core area and Weight of iron and copper ; optimum designs; Core design **–**Choice of flux Density; Design of windings, Window space factor, window dimensions, Width of window for optimum output; Design of yoke ,Overall Dimensions; Temperature Rise of transformers; Design of Tank with Tubes.

Three phase Induction Motors- Design Output equation, Choice of average flux density in air gap, Choice of ampere conductors per meter, Main dimensions, design of stator and rotor, design of squirrel cage rotor, design of end rings.

Synchronous Machines: Output equation, Choice of specific magnetic loading, choice of specific electric loading, Design of salient pole machines- Main dimensions, short Circuit Ratio (SCR). Length of air gap, Design of turbo alternators-Main Dimension

Unit V

Computer Aided Design :Introduction, Advantages of Digital computers , Computer Aided Design,- different approaches: Analysis method, Synthesis method, Hybrid method, Optimization, General procedure for Optimization, variables and constraints, Flow chart for transformer design, Flow chart for designing an Induction motor, Synchronous machines.

Suggested Reading:

1. A.K.Sawhney, *A Course in Electrical Machines Design,* Dhanpat Rai and Sons, 1996.
2. R.K.Agarwal, *Principles of Electrical Machines Design,*
3. S.K.Kataria & Sons, 4th edition, 2000, Nai Sarak, New Delhi.

EE 4030 HIGH VOLTAGE DC TRANSMISSION

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Course Objectives	Course Outcomes
To provide the knowledge on comparison of HVAC and HVDC transmission system, the different configurations of converter and inverter circuits, desired features and combined characteristics of control rectifier and inverter circuits, protection against over voltage and over current systems, different types MTDC system and control schemes.	Students will be: 1. Able to classify the cost comparison of AC and DC system
	2. Able to draw an explain the different configuration of converter and inverter circuits.
	3. Able to draw and explain the combined characteristics, control and their applications of rectifier and inverter circuits.
	4. Able to explain the protection schemes of over voltage and over current systems.
	5. Able to explain the comparison between series and parallel MTDC systems.

UNIT - I

General consideration of DC and AC Transmission Systems: Comparison of AC and DC Transmission systems. Applications of DC transmission. Economic consideration . Kinds of DC links. Planning for HVDC Transmission. Modern Trends in DC Transmission. Corona loss in AC & DC systems, HVDC Transmission system based on voltage source converters.

UNIT - II

Converter Circuits: Properties of Converter Circuits, converter harmonics, Different kinds of arrangements, Analysis of bridge converters with grid control, with and without overlap angle. Equivalent circuit of rectifier.

Inversion : operation as an inverter – equivalent circuit of inverter.

UNIT - III

Control : Basics of reactive power control, Limitations of manual control. Desired features of control, combined characteristics of rectifier and inverter. Power reversal. Constant minimum ignition angle control. Constant current control. Constant extinction angle control. Microprocessor based digital control.

UNIT – IV

Protection : Short circuit current. Arc-back, Commutation failure, Bypass valves, DC reactors. DC circuit breakers. Protection against over current and over voltages, Harmonic filters.

UNIT - V

Multi-terminal DC systems: Application of MTDC systems, Types of MTDC systems. Comparison of series and parallel MTDC systems. Control of MTDC System.

SUGGESTED READING:

1. Kimbark E.W., Direct Current Transmission Vol- I , John Wiley, 1971.
2. Padiyar K.R., HVDC Power Transmission Systems, Wiley Eastern, 1990.
3. Arrillaga J., High Voltage Direct Current Transmission, Peter Peregrinus Ltd., London, Pegramon Press, 1983

EE-4040 HIGH VOLTAGE ENGINEERING

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Course Objectives	Course Outcomes
To provide the knowledge of break down mechanism in solid, liquid and gases, generation of high AC and DC voltages, high impulse voltages and currents, measurements of high voltage and current, high voltages of electrical equipments and transients in power system.	Students will be: 1. Able to study breakdown mechanism in solid liquid and gasses.
	2. Able to study the high voltage AC and DC currents, Impulse voltages and currents.
	3. Able to study the measurements of high voltage and current.
	4. Able to design high voltage electrical equipments and transient in power systems.

UNIT – I

Breakdown Mechanism of Gases, Liquids and Solid Materials : Mechanism of breakdown of gases – Townsend's First and second Ionization coefficients, Townsend's Breakdown Mechanism – The sparking potential, Paschen's Law, Penning effect, Corona discharges, time lag, breakdown in liquid dielectrics – Treatment of Transformer oil, Testing of Transformer oil and breakdown in solid Dielectrics.

UNIT – II

Generation of High DC and AC Voltages : Half wave Rectifier Circuit – Cockroft – Walton Voltage Multiplier Circuit – Electrostatic Generator – Van de Graff Generator – Generation of High AC Voltages – series Resonant Circuit.

UNIT – III

Generation of Impulse Voltages and Currents : Impulse Generator Circuits - Analysis of Circuits 'a' and 'b' – Multistage Impulse Generator circuit – Construction of Impulse Generator – Impulse Current Generation.

UNIT – IV

Measurement of High Voltage and Currents : Sphere Gap, Uniform Field spark Gap, Rod Gap-Electrostatic Voltmeter – Generating Voltmeter, Chubb - Fortescue Method, Impulse voltage Measurements using voltage dividers, Measurement of High DC, AC and Impulse currents, Measurements of Dielectric constant and loss factor - High voltage Schering bridge, Digital recorders, errors inherent in digital recorders.

UNIT – V

High Voltage of Electrical Equipment and Transients in Power Systems: Testing of Power Capacitors, Testing of Power Transformers, Testing of Circuit Breakers, Test Voltages, Lightning Phenomenon, Line Design based on Lightning, Switching Surge Test Voltage Characteristics, Over current and voltage protection, Ground wires – Surge protection of Rotating Machines.

SUGGESTED READING:

1. Turan Gonen, Electric Power Distribution Engineering, McGraw Hill Book Co., International student edition, 1986.
2. A.S.Pabla, Electric Power Distribution Engineering, Tata McGraw Hill publishing Ltd., 1997.
3. Kamalesh Das, Electric Power systems for Industrial Plants” Jaico Publishing House, 2007.

EE-4050 POWER QUALITY

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Course Objectives	Course Outcomes
1. To know different terms of power quality. 2. To Illustrate of voltage power quality issue - short and long interruption 3. To construct study of characterization of voltage sag magnitude and three phase unbalanced voltage sag. 4. To know the behavior of power electronics loads; induction motors, synchronous motor etc by the power quality issues 5. To prepare mitigation of power quality issues by the VSI converters.	Upon the completion of the subject, the student will be able to 1. Know the severity of power quality problems in distribution system; 2. Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage) 3. compute the concept of improving the power quality to sensitive load by various mitigating custom power devices

UNIT-I

Introduction: Introduction of the Power Quality (PQ) problem, Terms Used in PQ: Voltage Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring. Power Quality Data: Data collection, Data analysis, Database Structure, Creating PQ databases, Processing PQ data.

UNIT-II

Voltage sag -characterization: Voltage sag -definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration. Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT-III

PQ considerations in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, mitigation of harmonics. Characterization of voltage sags experienced by three-phase ASD systems: Types of sags and phase -angle jumps. Effects of momentary voltage dips on the operation of induction and synchronous motors. Voltage sag coordination for reliable plant operation.

UNIT-IV

Effects of Harmonics on Power Quality: Harmonic analysis of industrial customers, technical barriers in ASDs. Methods of evaluation of harmonic levels in industrial distribution systems. Harmonic effects on transformers. Impact of distribution system capacitor banks on PQ. Guidelines for limiting voltage harmonics.

UNIT-V

Power Quality Monitoring: Introduction, site surveys, Transducers, IEC-measurement techniques for Harmonics, Flicker, IEC Flicker meter.

Suggested Reading:

1. Math HJ Bollen, "Understanding Power Quality Problems ", IEEE I Press.
2. C. Sankaran, "Power Quality" CRC Press.
3. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009.

EE-4060 NUCLEAR ENERGY

Instruction	:	3 Periods+1 tutorial/Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Course Objectives	Course Outcomes
1. To teach students fundamental physics that applies to a broad range of nuclear technologies. 2. To begin to introduce students to the analytical methods used in nuclear engineering and radiological science. 3. To introduce students to environmental impacts of nuclear technology, and the physical and biological effects of ionizing radiation	1. Understand basic nomenclature of nuclear physics, including how to find information on the Chart of the Nuclides, X(a,b)Y reaction notation, and radioactive decay types 2. Compute decay constants from half-life and vice versa 3. Describe the natural decay chains and environmental radiation 4. Describe the fundamentals of sustained neutron chain reactions, fission reactor design, and fission products. Derive the 4- and 6-factor formula from basic balance arguments. Define and describe BWR and PWR and enumerate the basic systems of each reactor type. Describe international reactor types, including GCR and PBMR, CANDU and LMFBR. 5. Understand the guiding principles of reactor safety and the lessons learned from past accidents.

UNIT-I

Introduction to Nuclear Physics: Basic nuclear properties, mass and abundance of nuclides, nuclear mass and binding energy, radioactive decay, units for measuring nuclear radiation and radiation dose. Alpha decay, beta decay, gamma decay; detection of nuclear radiation, nuclear reactions, neutron physics, nuclear fission, chain reaction, controlled fission reactors, atom bomb, nuclear fusion controlled fusion reactors, hydrogen bomb.

UNIT-II

Various types of Nuclear Reactors: Types of nuclear materials- fuels, moderators, coolants, control rods, shielding materials etc. PWR, BWR, Heavy water, CANDU, gascooled, liquid-metal cooled reactors, fast breed reactors.

UNIT-III

Nuclear Power Plants: Heat transfer aspects of nuclear power plants, Nuclear power plants: layout, site selection, controls and instrumentation, India's Programme for nuclear power, Survey of present nuclear power plants in India and future scenario.

UNIT-IV

Safety aspects of nuclear power reactors: Biological effects of nuclear radiation. Reactor shielding, Reactor safety, Nuclear power and environment, nuclear reactor accidents; review of the Three-Mile-Island accident, and the Chernobyl. accident. Storage and disposal of nuclear waste.

UNIT-V

Nuclear fusion reactors: Basic properties of nuclear fusion and thermo nuclear reactions, technology of controlled fusion reactors, International Thermonuclear Energy Research (ITER) project in France.

Suggested Reading:

I, Samuel Glasstone and A. Sesonke, " Nuclear Reactor Engineering" Vol 1 & 2.
2. J. Kenneth Shultis and Richard E. Faw, "Fundamentals of Nuclear Science and Engineering ".
3. John R.Lamarsh and Antony J.Baratta, "Introduction to Nuclear Power Engineering",

EE-4031 DIGITAL SIGNAL PROCESSING LABORATORY

Instruction	:	2 Periods/Week
Duration of Final Examination	:	3 hours
Final Examination	:	50Marks
Sessionals	:	25 Marks
Credits	:	1

COURSE OBJECTIVE	COURSE OUTCOME
The laboratory is aimed to provide basics in software implementation of signal processing and programming to control electrical machines.	1. Demonstrate the use of software to perform convolution of signals and transform signals between different domains. 2. Design analog and digital filters. 3. Interface electrical machines with digital signal processor. 4. Communicate effectively and support constructively towards team work.

List of Experiments

1. Discrete waveform generation – square, triangular, ramp and trapezoidal.
2. Verification of linear and circular and convolution theorem.
3. Computation of DFT, IDFT using direct and FFT methods
4. Verification of sampling theorem.
5. Design of Butterworth and Chebyshev LP & HP filters.
6. Design of LPF using rectangular, Hamming and Kaiser Windows.
7. LED interfacing with digital signal processor.
8. Stepper motor control using digital signal processor.
9. D.C Motor speed control using digital signal processor.
10. 3 - ϕ Induction motor speed control using digital signal processor.
11. Brushless D.C motor speed control using digital signal processor.
12. Key – pad interfacing with digital signal processor.

EE-4041 ELECTRICAL ENGINEERING COMPUTOR SIMULATION LAB

Instruction	:	2 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	50Marks
Sessionals	:	25 Marks
Credits	:	1

COURSE OBJECTIVE	COURSE OUTCOME
The objective of this lab is to provide basic knowledge about the different types of software which are used in electrical power system.	1. Students are able to simulate the electrical circuits by Using Software Tool 2. Students are able to analyze the power system by Using Software Tool 3. Students are able to control the speed of the motors by Using Software Tool

1. Verification of Network theorems (i) Thevenin's theorem (ii) Superposition Theorem & (iii) Maximum power transfer theorem – Using Software Tool.
2. Transient responses of Series RLC, RL and RC circuits with sine & step input – Using Software Tool.
3. Series and Parallel resonance – Using Software Tool.
4. Bode plot, Root – Locus plot and Nyquist plot – Using Software Tool.
5. Transfer function analysis (i) Time response for step input

   (ii) Frequency response for sinusoidal input – Using Software Tool.
6. Design of Lag, L*ead* and Lag-Lead compensators.
7. Load flow studies – Using Software Tool.
8. Fault Analysis – Using Software Tool.
9. Transient stability studies - Using Software Tool.
10. Economic power scheduling.
11. Load frequency control – Using Software Tool.
12. Chopper fed D.C motor drives.
13. VSI/ CSI fed Induction motor drives - Using Software Tool.

EE-4011 MICROPROCESSORS AND MICROCONTROLLERS LAB

Instruction	:	2 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	50Marks
Sessionals	:	25 Marks
Credits	:	1

Course Objective	Course Outcomes
1. To introduce to students the basics of microprocessor and microcontroller programming and their applications.	1. To familiarize with the assembly level programming. 2. Design circuits for various applications using microprocessor and microcontrollers. 3. An in-depth knowledge of applying the concepts on real- time applications.

I. Microprocessor 8086 : using MASM/TASM

1. Programs for signed/unsigned multiplication and division
2. Program for finding average of N 16 bit
3. Program for finding largest number in an array
4. Program for code conversion like BCD to 7-segment
5. Program for compute factorial of a positive integer number.
6. String Manipulation instructions
7. use of JUMP and CALL instructions
8. Macro and Procedure instructions

II. Interfacing :using 8086 Kit

1. 8279– Keyboard Display : Write a small program to display a string of characters.
2. 8255– PPI : Write an ALP to generate triangular wave using DAC.
3. 8253-timer/counter. Application of different modes
4. 8251 – USART : Write a program in ALP to establish Communication between two processors.
5. Traffic signal controller
6. ADC interfacing

III. Microcontroller 8051 :

1. Data transfer- Block of move, exchange, sorting ,finding largest element in an array.
2. Arithmetic instructions: Multi byte operations
3. Boolean & logical instructions(Bit manipulations)
4. Programs to generate delay, programs using serial port and on chip timer/counter.
5. Use of JUMP and CALL instructions

Program Development using ‘C’ cross compiler for 8051

1. Square wave generation using timers.
2. Interfacing of keyboard and 7-segment display module.
3. ADC interfacing for temperature monitoring.
4. DAC interfacing for generation of sinusoidal wave.
5. Stepper motor control(clock wise, anti clockwise, in precise angles
6. LCD interfacing

IV. Proteus Software

1. Introduction to Proteus software
2. LED Interfacing
3. LCD interfacing
4. Keyboard interfacing

EE4021 - POWER SYSTEMS LABORATORY

Instruction	:	2 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	50 Marks
Sessionals	:	25 Marks
Credits	:	1

COURSE OBJECTIVE	COURSE OUTCOME
1. To allow students to practically verify several concepts and procedures learned in power systems and switchgear and protection 2. To promote teamwork among students and effective communication skills.	1. Student will be able to calculate parameters related to electric transmission line, alternators and transformers 2. Student will be able to understand the a relay operation and use them 3.Students will be able to understand insulators and their propoerties

List of Experiments:

1. Determination of regulation and efficiency of an artificial transmission lines.
2. IDMT characteristics of Over-current relay & Study of Bucholz relay.
3. Determination of A, B, C, D constants of short, Medium and Long lines. Drawing of circle diagrams.
4. Differential protection of single phase transformer.
5. Sequence impedance of 3-phase Alternators.
6. Determination of positive, negative and zero-sequence reactance of three phase Transformers using sequence current excitation fault calculation.
7. Synchronous machine reactance and time constant from 3-phase S.C. set.
8. Characteristics of Static relays.
9. Static excitation of Synchronous Generator.
10. Determination of dielectric strength of insulating oils and study of Megger.
11. Parallel operation of two 3- phase alternators.
12. Measurement of capacitance of 3-core cables
13. Fault location of Underground cables.
14. Determination of voltage distribution and String efficiency of string of insulators.
15. Fault analysis of Alternator

16. Simulation of transmission line using software tool (ABCD constants, Efficiency and regulation of transmission line)
17. Simulation for determination of voltage distribution and String efficiency of string of insulators using software tool.

At least ten experiments should be completed in the semester.

Modifications:

1. Fault analysis of Alternator is added
2. Simulation of transmission lines using MATLAB is added

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION W.E.F. 2018-2019 UNDER AUTONOMY

B.E 4th Year - II – SEMESTER

S.NO	Subject Reference Code	Subject	Scheme of Instructions				Scheme of Examination			
			Periods per week				Duration in Hrs	Maximum Marks		Credits
			L	T	D	P		SEE	CIE	
		THEORY								
1	EE-4XXX	Elective - II	3	0	-	-	3	70	30	3
2	EE-4XXX	Elective - III	3	0	-	-	3	70	30	3
3	EE-4019	Project Work / Internship		-	-	18	Viva-voce	50	50	9
		TOTAL	**6**	**0**	**-**	**18**		**190**	**110**	**15**
		Grand Total	**24**					**300**		

- **Elective – II**

1. EE-4070: Electrical Power Distribution Engineering
2. EE-4080: Advanced Control systems
3. EC-4110: Optimization Techniques
4. EC-4020: VLSI Design
5. CE-4531: Disaster Mitigation and Management

- **Elective – III**

1. EE-4090: Renewable Energy Sources
2. EE-4100: Transducers
3. EE-4110: Power System Reliability
4. EE-4120: Electronic Instrumentation systems
5. EE-4130: EHV AC Transmission
6. EC-4070: Digital Image Processing
7. XX-XXXX: Soft Computing

*** BOS Members may kindly permit us for any modification of subject code in future.**

EE-4070 ELECTRICAL POWER DISTRIBUTION ENGINEERING

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Course Objectives	Course Outcomes
1. To provide knowledge on structure of Electrical Distribution System	**1.** Able to classify, define, explain, signify, handle, calculate Power Distribution elements and parameters.
2. To provide knowledge on performance of Electrical distribution system.	**2.** Able to design the primary and secondary distribution system elements and calculate the total annual cost of the system
3. To provide knowledge on Distribution Automation.	**3.** Able to select the capacitors optimally for the distribution system. Able to calculate voltage drop in the system and identify the different wiring arrangements
	4. Able to identify, define and explain the parameters and functions related to Distribution Automation.

UNIT – I

Load Modeling and Characteristics: Introduction, Load characteristics, Diversified demand, non-coincident demand, coincidence factor contributions factor problems, Load modeling

UNIT – II

Distribution feeders: Design considerations-LVDS-HVDS, Factors affecting feeder voltages-Application of ABCD parameters to feeder circuits-design practice of secondary distribution systems-distribution transformers-secondary network types-secondary mains.

UNIT – III

Voltage drop and power loss calculation,: 3-phase , non-3-phase primary lines, single phase two wire laterals with ungrounded neutral, single phase two wire ungrounded laterals. Application of capacitors to distribution systems, Effect of series and shunt capacitors, power factor correction, Economic justification for capacitors, Best capacitor location.

Unit IV

Distribution system Protection : Objectives-protection schemes- Circuit Breakers-Sectionalizers-Coordination of protective devices-objectives-types of coordination-classification of faults-fault calculations.

UNIT – V

Distribution Automation: Project planning, Communication, SCADA, ConsumerInformation Service (CIS), Automatic Meter Reading (AMR)

SUGGESTED READINGS:

1. Electric Power Distribution and Automation by S.Sivanagaraju and V.Sankar, DhanpatRai and Co.
2. Turan Gonen, Electric Power distribution Engineering, McGraw Hill Book Co., International Student Edition, 1986.
3. A.S.Pabla, Electric Power Distribution, Tata McGraw Hill publishing Ltd., 1997
4. Kamalesh Das, Electric Power Systems for Industrial Plants" Jaico Publishing House, 2007.

EE-4080 ADVANCED CONTROL SYSTEMS

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the basics of mathematical modeling 2. To study the stability analysis of linear and non linear systems	1. develop mathematical models and understand the mathematical relationships between the sensitivity functions and how they govern the fundamentals in control systems. 2. design and fine tune PID controllers and understand the roles of P, I and D in feedback control 3. design pole-assignment controller and the specific design procedures 4. develop state-space models 5. design state feedback controller and state observer

UNIT-I

Review of state-space representation of continuous time systems and their solution, state models for discrete time systems described as difference Equations and transfer functions, Transfer function from State model, State-Transition matrix and solution of state equations for discrete time systems.

UNIT--II

Controllability and Observability: Concepts of Controllability and Observability, Controllability tests for continuous time, discrete-time, time-invariant systems. Observability tests for continuous time, discrete- time, time-invariant systems. And Controllability and Observability modes in State. Jordan's canonical form, Controllable and Observable companion forms for single input single output Systems, pole placement by State feedback.

UNIT-III

Nonlinear systems: Behavior of Nonlinear systems, jump resonance, Sub-harmonic oscillation, Limit cycles, common physical non-linearities, Singular points, phase planemethod, Construction of phase plane trajectories, Isoclines method, Delta method, Computation of time.

UNIT-IV

Stability: Lyapunov's stability criteria, Theorems, Direct method of Lyapunov For linear systems, Non-Linear Systems, Methods of constructing Lyapunov function, Krasovki's Method, Variable gradient method.

UNIT-V

Optimal Control: Formulation of optimal control problem, calculus of variations Minimization of functional. Formulation of variational calculus using Hamiltonianmethod.

Suggested Reading:

1. Gopal.M., Modern Control System Theory, Wiley Eastern Limited, 2004.
2. Schulz D.G., Melsa J.L., State Functions Linear Control Systems, McGraw Hill.

EC-4110 OPTIMIZATION TECHNIQUES

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems 2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology 3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems	1. Have a basic understanding of numerical optimization algorithms. 2. Formulate engineering design problems as mathematical optimization problems. 3. Use mathematical software for the solution of engineering problems. 4. Several homework assignments delving on core concepts and reinforcing analytical skills learned in class. 5. Computer assignments included in the homework assignments and/or 1 or 2 computer projects. Opportunity to conduct software projects requiring some independent reading, programming, simulations and technical writing.

UNIT-I

Introduction to classical optimization techniques: Statement of optimization problem, Objective function, Classification of optimization problems.

Classical optimization techniques: Single-variable & Multi-variable Optimization without constraints. Multi-variable optimization with equality Constraints. Lagrange multiplier method, Multi-variable optimization with inequality constraints, Kuhn- Tucker conditions.

UNIT-II

Linear programming: Standard form, Formulation of the LPP, Solution of simultaneous equations by Pivotal condensation, Graphical method, Simplex algorithm, Big M method, Two phase Simplex method, Duality principle, Dual Simplex method.

UNIT-III

Non-Linear Programming: One dimensional Search method: Fibonacci method, Golden Section method.

Direct Search method: Uni-variate Search and Pattern Search methods, Powell's method.

UNIT -IV

Gradient method: Steepest Descent, Conjugate Gradient and Quasi- Newton method, Fletcher-Reeves method of Conjugate gradients.

UNIT -V

Dynamic Programming: Multistage design process, Types, Principle of optimality, Computational procedure in Dynamic programming, Examples using Calculus method and Tabular method of solutions.

Suggested Reading:

1. S.S.Rao, Engineering Optimization Theory and Applications, New Age International, 3rdEdition, 1998.
2. Jasbir S.Arora, Introduction to Optimum Design, McGraw Hill International Edition, 1989.
3. S.D. Sharma, Operational Research, Kedarnath Ramnath & Co., 2004.

EC-4020 VLSI DESIGN

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
. To bring both Circuits and System views on design together. 2. It offers a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design.	After studying this course the students would gain enough knowledge 1. To be aware about the trends in semiconductor technology, and how it impacts scaling and performance. 2. Able to learn Layout, Stick diagrams, Fabrication steps, Static and Switching characteristics of inverters 3. Synthesis of digital VLSI systems from register-transfer or higher level descriptions in hardware design languages. 4. To understand MOS transistor as a switch and its capacitance. 5. Student will be able to design digital systems using MOS circuits.

UNIT-I

Review of semiconductor devices, Passive components for ICs, Device structures, BJTS, JFETS, MOSFETS -depletion type and enhancement type. Basic logic (Gates) circuits with BJT , MOSFETS (N-MOS, P- MOS, BiCMOs. Sequential Circuits -'Flip lops & Latches. Concept of Sheet resistance - Resister d sign, capacitor design – Considerations for the Design of BJT, MOS ET.

UNIT-II

Circuit or Cell Design, Importance of aspect ratio in FETS, emitter area in BJTS. Design of Inverters with different loads, design of AND, OR, NAND, NOR Gates, Influence of FAN -and FAN OUT on Gate design, Design of latches and Flip Flops.

UNIT-III

System level design considerations, Counters shift registers, Arithmetic logic Unit, Multiplexer, memories -ROM, S tic RAM, Dynamic RAM. CAD tools -Simulation and Synthesis.

UNIT -IV

Different layers of ICs, (Unit Processes) wafer preparation -Epitaxy, Diffusion, Ion implantation, oxidation, Chemical vapor deposition, Optical lithography, Etching, Metalization, Bonding, Packaging and testing. Process flow for N-MOS, CMOS, BiCMOS.

UNIT-V

Basic current mirrors and single stage amplifiers, simple CMOS current Mirror, common source, common drain and co on gate amplifiers, bipolar current mirrors, basic operational amplifier.

Suggested Reading:

1. Douglas A. Pucknell & Kamran Eshraghian," Basic VLSI Design ", 3/ e, Prentice Hall India, 2001.
2. Wayne Wolf, "Modern VLSI Design: System -on-chip design", Pearson Education, 3/e, 2002.
3. David A. Johns & Ken Martin, "Analog Integrated Circuit Design ", John Wiley & Sons, 2004.
4. Neil. H.E. Weste & Kamran Eshraghian," principles of CMOS VLSI Design: A systems perspective ", 2/e, Pearson Education, 2004.

EE-4090 RENEWABLE ENERGY SOURCES

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

Prerequisites: Engineering Physics, Engineering Chemistry and Power Systems-I

COURSE OBJECTIVES	COURSE OUTCOMES
To provide a survey of the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state- of -the-art energy systems.	After completion of the course, students will be able to: **1:** Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells. **2:** Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation. **3:** Explore the concepts involved in wind energy conversion system by studying its components, types and performance. **4:** Illustrate geothermal energy and ocean energy and explain the operational methods of their utilization. **5:** Acquire the knowledge on harnessing biomass as a source of energy and analyze photosynthetic efficiency.

UNIT-I

Fuel cells: Types of Non- conventional energy sources , Fuel Cells : Principle of operation with special reference to H_2-O_2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system-Regenerative Fuel Cell – Work output and Emf of fuel cell- Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar Energy:

Solar Radiation and its Measurements: Solar constant-Solar radiation at the earth’s surface-Solar radiation geometry-Solar radiation data- Solar radiation measurements.

Solar Energy Collectors: Flat plate collectors- Concentrating Collectors: Focusing and Non-Focusing-Solar pond.

Solar Photovoltaics: p-n junctions- Solar cells- PV systems: Standalone and Grid interactive solar systems.

Applications of Solar Energy: Solar thermal electric conversion- Solar water heating- Solar cooking.

UNIT-III

Wind Energy: Principles of wind energy conversion :Nature of wind - Power in the Wind-Forces on blades-Basic components of WECS -Classification of WECS -Advantages and disadvantages of WECS -Wind energy collectors –Performance of wind machines- wind energy generators - Wind electric generating and control systems - Site selection considerations - Environmental aspects- Applications of Wind energy.

UNIT-IV

Energy from the Ocean and Geothermal Energy:

Ocean thermal electric conversion(OTEC): Open cycle- Closed cycle - Hybrid cycle systems.

Energy from tides: Basic principle of tidal power- Components of tidal power plants- Operation methods of utilization of tidal energy- Advantages and limitations of tidal power generation.

Ocean waves: Wave energy conversion devices-Advantages and limitations of wave energy**.**

Geothermal Energy: Nature of geothermal fields-Geothermal Sources.

UNIT-V

Energy from Biomass: Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass.

Suggested Reading:

1. G.D. Rai, *Non-Conventional Energy Sources* , Khanna Publishers, New Delhi, 2011.
2. B H KHAN, *Non-Conventional Energy Resources*, McGraw Hill, 2nd Edition, 2009.
3. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
4. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
5. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 1997.

EE-4100 TRANSDUCERS

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1.In-depth understanding of specialist bodies of knowledge within the engineering discipline. 2. Application of established engineering methods to complex engineering problem solving. 3. Fluent application of engineering techniques, tools and resources.	1. Describe and interpret important physical principles applied in sensors and actuators. 2. Design and fabricate sensors with desired physical and chemical properties. 3. Describe the various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors. 4. Use these sensors for physical, chemical, and biochemical applications.

UNIT-I

Basic methods of measurement, A generalized measurement system configuration, Basic characteristics of measuring devices: Accuracy,Precision, Error, Linearity, Hysteresis, Threshold, Repeatability, Reliability and maintainability, Span, Calibration.

UNIT-II

Performance characteristics of Instrumentation system, Generalized Mathematical model of system, Transfer function representation, Sinusoidal transfer function: Zero, First and Second order instruments, Impulse, Step, Ramp and Frequency .responses of above instruments, Specification and testing of Dynamic response.

UNIT-III

Transducer: Definition, Electrical Transducers: Classification. Basic Requirement of transducers, Variable resistance transducers, Construction And characteristics of Potentiometers, Application, Electrical Strain gauge: Theory of operation of Resistance Strain gauge, Gauge factor, Types of Electric Strain gauges: Wire gauges. Unbonded and bonded Strain gauges, Foil gauges, Semiconductor Strain gauges. Materials for Strain Gauges, Installation of Strain gauges, Strain measuring circuits, Related problems.

UNIT-IV

Resistive type temperature measuring transducers: Platinum resistance transducer, Thermistor, Thermocouples: Types of thermocouples, Variable inductance and Capacitive transducers, Construction details of different types of inductance transducers:

L VDT, Application, Induction Potentiometer. Types of Variable Cpacitive Transducers, Applications.

UN IT-V

Other Transducers: Piezo- Electric transducers, Characteristics, Hall effect sensors, Eddy current sensors, Digital Transducers, Fiber-optic sensors Electro-optic transducers. Semiconductor sensors .

Suggested Reading:

1. C.S.Rangan. G.R.Sarma and V. S. V.Mani, Instrumentation Devices & Systems. Tata McGraw Hill Publications, 1983.

2. D. V.S.Murthy, Transducers and Instrumentation, Prentice Hall of 1 India (P) Ltd., 1997.

EE-4110 POWER SYSTEM RELIABIITY

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1. To identify the generation system model and recursive relation for capacitive model building 2. To calculate the equivalent transitional rates, cumulative probability and cumulative frequency 3. To classify the risk, system and load point reliability indices 4. To evaluate the basic reliability indices	Upon the completion of the subject, the student will be able to 1. Find loss of load and energy indices for generation systems model 2. Describe merging generation and load models 3. Apply various indices for distribution systems

UNIT -I

Elements of probability theory -Probability distributions: Random variables, density and distribution functions, Mathematical expectation- Mean and Variance, Binominal distribution, Poisson distribution, Normal .distribution, Exponential distribution, Weibull distribution.

UNIT-II

Definition of Reliability. Component reliability, Hazard rate, derivation of the reliability function in terms of the hazarad rate. Causes of failures, types of failures. Bath tub curve, MTTR, MTBF. Reliability logic diagrams for series, parallel, series-parallel, non-seriesparallel I configurations. Minimal cut-set and decomposition methods.

UNIT-III

Discrete Markov Chains: General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states. Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state Probabilities. Reliability evaluation of repairable systems.

UNIT-IV

Generating System Reliability Analysis: Generation system model- capacity outage probability tables - Recursive relation for capacitive model building '- sequential addition method -unit removal- Evaluation of loss of load and energy indices. Frequency and Duration methods- Evaluation of equivalent transitional rates of identical and nonidentical units -Evaluation of cumulative probability and cumulative frequency of nonidentical generating units -2'-level daily load representation - merging generation and load models

UNIT-V

Distribution System Reliabiliry Analysis: Radial networks –Evaluation of Basic reliability indices, performance indices -load point and system reliability indices - customer oriented, loss and energy oriented indices. Parallel networks- inclusion of bus bar failures, scheduled maintenance -temporary and transient failures -weather effects - common mode failures -Evaluation of various indices.

EE-4120 ELECTRONIC INSTRUMENTATION SYSTEMS

Instruction	:	3 Periods /Week
Duration of Final Examination	:	3 hours
Final Examination	:	70Marks
Sessionals	:	30 Marks
Credits	:	3

COURSE OBJECTIVES	COURSE OUTCOMES
1.To introduce students to monitor, analyze and control any physical system. 2 . To understand students how different types of meters work and their construction 3 .To provide a student a knowledge to design and create novel products and solutions for real life problems. 4 To introduce students a knowledge to use modern tools necessary for electrical projects.	1. To use the techniques and skills for electrical projects. 2. Design a system, component or process to meet desired needs in electrical engineering. 3. Measurement of R,L,C ,Voltage, Current, Power factor , Power, Energy 4. Ability to balance Bridges to find unknown values. 5. Ability to measure frequency, phase with Oscilloscope 6. Ability to use Digital voltmeters 7. Ability to measure strain, displacement, Velocity, Angular Velocity, temperature, Pressure ,Vacuum, and Flow

UNIT-I

Analog and Digital Measuring Systems: Interfacing Active and Passive Transducers. Amplifiers: Instrumentation amplifiers (Fixed and Programmable gain types and its specifications), Isolation amplifiers (Types and its specifications).

Digital to Analog Converters: R-2R ladder and Inverted ladder DACs. Main DAC specifications. Analog to Digital Converter: R-2R Ladder and Inverted Ladder DACs, Main DAC specifications, Analog to Digital Converters: Parallel (or Flash) ADC successive approximation, ADC Microprocessor compatibility, Dual slope ADC, Principal specifications of an ADC.

UNIT-II

Digital Voltmeters and Multimeters: Simple D.C Voltage attenuator, Current to Voltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing RMS detector in DMM and RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, frequency ratio Time Interval and Pulse width measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

UNIT-III

Signal Analysis: Wave Analyzers: Signal analysis and wave Analyzer: Type and Applications. Harmonic Distortion Analyzers: harmonic Distortion, heterodyne harmonic Analyzer or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, Successive Limiting type of Log IF amplifier.

UNIT-IV

Computer Controlled Test Systems: sting an Audio amplifier, Radio Receiver instruments used in computer controlled instrumentation, Frequency counter, Synthesized signal generator interfaced with IEEE 488 Bus, Relay switched attenuator, IE E 488 Electrical Interface.

UNIT-V

Cathode ray Oscilloscope: Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO, Digital storage Oscilloscope, Magnetic Re orders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation.