Board of Studies
Electrical Engineering Bharati Vidyapeeth
University, Pune

STRUCTURE AND THE SYLLABI

B.TECH. [ELECTRICAL]

SEMESTER V AND VI

[2014 Course]

Bharati Vidyapeeth University, Pune

Faculty of Engineering & Technology

Programme: B.Tech (Electrical) Sem – V (2014 Course)

Sr. No.	Name of Course	Teaching Scheme			Examination Scheme							Credits		
		L	P	T	ESE	Continuous Assessment			Practical		Total	Theory	TW	Total
						Unit Test	Attendance	Assignment	TW PR	TW OR				
27	Linear Control Systems	3	2	--	60	20	10	10	--	50	150	3	1	4
28	Micro controller	3	2	--	60	20	10	10	--	50	150	3	1	4
29	Electrical Machine Design	4	2	1	60	20	10	10	--	50	150	5	1	6
30	Electrical Estimation, Costing &Installation	3	--	--	60	20	10	10	--	--	100	3	--	3
31	Elective - I	3	--	--	60	20	10	10	--	--	100	3	--	3
32	Professional skill development- 5	4	--	--	100	--	--	--	--	--	100	4	--	4
33	*Seminar	--	2	--	--	--	--	--	--	50	50	--	1	1
	Total	**20**	**8**	**1**	**400**	**100**	**50**	**50**	**--**	**200**	**800**	**21**	**4**	**25**

Optional Subject

Sr. No.	Name of Course	Teaching Scheme			Examination Scheme							Credits		
		L	P	T	ESE	Continuous Assessment			Practical		Total	Theory	TW	Total
						Unit Test	Attendance	Assignment	TW PR	TW OR				
15	Engineering Mathematics IV	4	--	--	60	20	10	10	--	--	100	4	--	4

Bharati Vidyapeeth University, Pune
Faculty of Engineering & Technology
Programme : B.Tech (Electrical) Sem –VI (2014 Course)

Sr. No.	Name of Course	Teaching Scheme			Examination Scheme							Credits		
		L	P	T	ESE	Continuous Assessment			Practical		Total	Theory	TW	Total
						Unit Test	Attendance	Assignment	TW PR	TW OR				
34	Switchgear and Protection	3	2	--	60	20	10	10	--	50	150	3	1	4
35	Power System Analysis	4	2	--	60	20	10	10	50	--	150	4	1	5
36	Modern Control Systems	4	2	--	60	20	10	10	--	50	150	4	1	5
37	Elective - II	3	2	--	60	20	10	10	--	50	150	3	1	4
38	Industrial Organization & Management	3	--	--	60	20	10	10	--	--	100	3	--	3
39	Professional Skill development- 6	4	--	--	100	--	--	--	--	--	100	4	--	4
40	**Mini Project	--	2	--	--	--	--	--	--	--	--	--	--	--
	Total	**21**	**10**	**--**	**400**	**100**	**50**	**50**	**50**	**150**	**800**	**21**	**4**	**25**

**** Mini Project : (Individual student has to carry out the mini project activity and it will be allotted following grade as per his/her performance in term work. The grades are A+, A, B+, B, C, D)**

Marks	Grades
>= 45 to 50	A+
>= 40 to > 45	A
>= 35 to > 40	B
>= 30 to > 35	B+
>= 25 to > 30	C
> 25	D

Total Credits Sem – III : 25
Total Credits Sem – IV : 25
Grant total : 50

Linear Control Systems

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral 25marks	01 Credit

Course Prerequisites:

The students should have knowledge of

Mathematics , Laplace transform , Ordinary differential equation

Course Objectives:

This course introduces concepts of feedback control system. It provides foundation for mathematical modeling of components. It includes application of analytical and graphical techniques for stability analysis of system. These techniques can be used for any industrial system.

Course Outcomes: After learning this course the students will be able to

1.	Calculate transfer function of components using mathematical equations.
2.	Draw block diagram and signal flow graphs of system and evaluate overall transfer function of closed loop system.
3.	Apply different techniques for stability analysis of any system in time domain.
4.	Design PID controller and design compensator using root locus technique.
5.	Draw Bode plot and Nyquist. plot and comment about stability in frequency domain.
6.	Design a system using compensator to meet the desired needs and specifications by bode plot

UNIT I	**Introduction**	**(06 Hours)**
	Classification of control system, open loop, closed loop, examples, Block Diagram reduction, signal flow graph, Mason's gain formula. Mathematical Modeling and Transfer function of Electrical, mechanical system , Analogy for mechanical and electrical systems, Potentiometer, Synchros, AC- DC Servomotor, Stepper motor, Gear Trains, AC-DC servomechanism, Tachogenerator, optical encoder	
UNIT II	**Time domain analysis**	**(06 Hours)**
	Standard test signals, Type and order of the system ,Time response of first and second order system to unit step input , Specifications for second order system, Steady state error, static error constants, Characteristic Equation, its roots in complex plane and time response	
UNIT III	**Stability analysis in time domain**	**(06 Hours)**
	Concept of stability absolute, relative, Routh-Hurwitz stability criteria , special cases, limitations. Root Locus: Basic properties of root locus. Construction of root locus. Angle and magnitude condition for stable	

	system. Determination of gain for specified damping ratio, Effect of pole, zero addition on root locus, cancellation of poles and zeros	
UNIT IV	**Design in time domain**	**(06 hours)**
	Basic concept of PID controller, tuning rules of PID controller, step response of system without and with PID controller, rate feedback , Need of compensation, transfer function of lead, lag, lag- lead , lead and lag compensator design using root locus. Use of SISO design tool in MATLAB	
UNIT V	**Frequency domain Analysis**	**(06 Hours)**
	Frequency response of first order and second order system to sinusoidal input, frequency domain specifications, Correlation between time domain and frequency domain , Polar plot, Nyquist stability Criteria, Nyquist plot, Gain margin, Phase margin and stability analysis using polar plots, Bode plot, Determination of Gain margin , phase margins and stability analysis using Bode Plot, Deduction of transfer function using bode plot	
UNIT VI	**Design in frequency domain**	**(06 Hours)**
	Bode plot of lead, lag, lag- lead compensating network, Design specifications, Design of lead, lag compensators using bode plot. Comparison of lag, lead compensator effect on system performance. Use of SISO design tool in MATLAB	

Term Work:

The term work shall consist of record of minimum eight experiments. Four from first seven, four from next seven and to ensure at least one experiment on each unit.

1. To plot characteristics of potentiometer and observe potentiometer pair as an error detector.
2. To plot characteristics of Synchro and observe Synchro pair as an error detector.
3. To determine transfer function of D C servomotor.
4. To observe step response of RLC series circuit for different values of R.
5. To analyze i) effect of gain ii) effect of tachometer feedback on output response of D.C. position servomechanism
6. To tune PID controller and analyze step response of temperature/ pressure control system.
7. To plot root locus using MATLAB and determine value of K for given value of damping ratio from the plot. ii) To analyze effect of addition of zero/ pole on root locus
8. To observe frequency response and to draw bode plot of lag, lead network.
9. To analyze stability of system in frequency domain by i) Nyquist plot ii) Bode plot using MATLAB .
10. To design lead compensator using bode plot and observe step response of uncompensated and compensated system.(SISOTOOL in MATLAB)
11. To design lag compensator using root locus technique and observe step response of uncompensated and compensated system. .(SISOTOOL in MATLAB)
12. To design PID controller for second order system to obtain desired performance specifications**.**
13. To use various commands for block diagram reduction like series, parallel, append, connect, feedback.(MATLAB)

14. To calculate steady state error for different inputs and different types of system(MATLAB)	
Text Books:	
1. I.J. Nagrath, M. Gopal, ""Control System Engineering", New Age International Publishers – Fourth edition	
2. Katsuhiko Ogata, "Modern control system engineering", Prentice Hall, 2010.	
3. M.N.Bandopadhyay, " Control Engineering Theory and practice"- Prentice Hall of India 2006	
Reference Books:	
1. Nise N. S. "Control Systems Engineering", John Wiley & Sons, Incorporated, 2011	
2. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005	
3. Dorf, Bishop - "Modern control system", Pearson Education	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments: Assignments should be able to verify course outcome and skills of group work, communication skills

1. To solve numerical on block diagram reduction to calculate overall transfer function of system and verify with Mason's gain formula
2. To calculate transfer function of equivalent electrical system for given mechanical system.
3. Quiz –Multiple Choice Questions 20
4. To solve numerical on time domain and analyze parameter variations on transient response and steady state error.
5. Solve two years question paper of Pune university unit wise.
6. Solve two years question paper of GATE unit wise.
7. To observe NPTEL video lecture by M. Gopal on any topic of control and give presentations, group discussion.
8. To collect information about controllers used in process control in thermal power plant.
9. To collect information about controllers used in power system for voltage and frequency control.
10. To collect information about controllers used in machine control.
11. To validate the design by hardware.

Microcontroller		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral : 25 Marks	01 Credit

Course Pre-requisites:		
The Students should have knowledge of		
1.	Digital electronics & Microprocessor 8085.	
Course Objectives:		
	This course introduces basic knowledge of Microcontroller 8031/51 & PIC Microcontroller.	
Course Outcomes:		
1.	Understand basic architecture and block diagram of microcontroller 8051.	
2.	Understand the different addressing modes and use them to write instructions	
3.	Understand the basics of interrupt structure of 8051	
4	Understand the 8051 programming.	
5	Introduction to PIC microcontrollers	
6	Understand PIC peripherals	
	Introduction	
UNIT - I	Introduction to the concept of micro-controllers. Comparison of microprocessor and microcontroller. Difference between RISC and CISC microcontrollers. Harvard and Von Neumann Architectures, Architecture of 8031/51 microcontroller, Pin diagram, special function registers. Ports, Internal Memory, External memory, Counters and timers in 8051,Clock, Timer modes.	**(06 Hours)**
UNIT - II	**MCS-51 Addressing modes and Instructions**	
	Addressing modes, MCS-51 Instruction set, external data moves, code memory read only data moves, Push and Pop, data exchanges, byte level logical operations, bit level logical operations. Rotate and swap operations. Instructions affecting flags, incrementing/decrementing, Arithmetic operations, Jump and call instructions.	**(06 Hours)**
UNIT - III	**Interrupts**	
	Serial data I/O, serial data mode interrupt, serial port interrupt, external hardware interrupts, software generated interrupts, interrupt control, interrupt priority in the 8051.	**(06 Hours)**
UNIT - IV	**Applications**	
	Applications like Interfacing of 8051 with ADC , Interfacing of 8051 with DAC Interfacing of 8051 to stepper motor, Interfacing of 8051 to DC motor, Application for Traffic Control System.	**(06 Hours)**

UNIT - V	**Introduction to PIC Microcontroller**	
	Introduction to PIC 16F8XX family and development tools. CPU architecture and instruction set. Harvard architecture and pipelining, program memory considerations, register file structure and addressing modes, CPU registers.	**(06 Hours)**
UNIT - VI	**PIC Peripherals**	
	I/O ports, external interrupts and timers, timer operation, ADC, short overview of synchronous serial port, serial peripheral interface I2C bus.	**(06 Hours)**

Term Work:

The term work shall consists of record of minimum eight experiments

1. Programs of addition, subtraction, multiplication etc.
2. Programs on logical and decision making group of instructions
3. Programs related to interrupt, timer and serial communication logic.
4. Programs related to data transfer between internal and external memory.
5. Simulator based programming.
6. Interfacing of 8051 with ADC
7. Interfacing of 8051 DAC
8. Interfacing of 8051 to stepper motor, DC motor
9. Application for Traffic Control System.
10. Interfacing PIC with LCD.
11. ADC conversion with PIC.
12. Interfacing PIC with keyboard.

Text Books:

1. B.Ram "Fundamentals of Microprocessors and Microcomputers", edition 1995 Dhanapat Rai Publications
2. Ajay Deshmukh, 'Microcontrollers Theory and Applications', TATA McGraw Hill.
3. Myke Predko, 'Programming and customizing the 8051 microcontroller', TATA McGraw Hill

Reference Books:

1. M.A.Mazidi "The 8051 micro controller & embedded systems", Pearson Education Publication
2. K.J.Ayala "The 8051 microcontroller Architecture programming and applications"
3. Kenneth Ayala , Delmar ,Cengage Fearning ," "The 8051 Microcontroller Architecture ,Programming & Applications" Third Edition , TATA McGraw Hill
4. Intel micro controller data book.
5. Microchip PIC family Microcontroller handbook
6. Design with PIC microcontrollers –John Peatman, Pearson Education Asia ,LPE

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. Group discussions on any one of the topics.
2. Watch the NPTEL video on this subject of any TWO modules and summarize it.
3. Open book class test on this subject.
4. Give presentation on PIC microcontroller.
5. Solve questioners in the class room on microcontroller.
6. List different microcontroller & compare them.
7. Prepare report on different microcontrollers used in your laboratory.
8. Give a presentation on “commercial aspects of microcontroller”.
9. Give presentation on different applications on PIC microcontroller.
10. Give presentation on different applications on 8051 microcontroller.
11. Program 8051 microcontroller for addition, subtraction & multiplication operations.
12. Write a note on PIC peripherals.
13. Study instruction set of 8051 microcontroller.
14. Study instruction set of PIC microcontroller.

Electrical Machine Design

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	05 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
Tutorial: 01 Hours/ Week	Term Work: 25 Marks & Oral: 25 Marks	01 Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Various Materials Used in Electrical Machines
2.	Types, construction & working of Transformers
3.	Types, construction & working of DC & AC Machines

Course Objectives:

	This course introduces Design of Electrical machines for the given specifications

Course Outcomes: The students will be able to

1.	Apply the concepts of machines and materials in design of machines.
2.	Analyze and estimate the transformer performance parameters
3.	To estimate the main dimensions and performance parameters of 3-Φ Induction Machines by understanding the general concepts and constraints in design.
4	To estimate the main dimensions and performance parameters of 1-Φ Induction Machines by understanding the general concepts and constraints in design.
5	To estimate the main dimensions and performance parameters of Synchronous Machines& DC machines by understanding the general concepts and constraints in design.
6	To use different software (AutoCAD) for design.

UNIT - I	**Fundamental Aspects, Thermal Design Aspects and General concepts, Constraints in design of Electrical Machines.**	**(10 Hours)**
	Introduction, Design factors, Limitations in design, Modern trends in Design of Electrical Machines, Basic Principles. Modes of heat dissipation, Heating and cooling curves, calculation of heating and cooling time constants, Rating of machines, selection of motor power ratings, Cooling of rotating of rotating machines, Types of duties and ratings and selection of motor capacity. Methods of measurement of temperature rise. Measurement of winding temperature. Relation between Rating and Dimensions of Rotating Machines: Main dimensions, Total loadings, Specific loadings, Output equation, Factors affecting size of rotating machines, Choice of specific magnetic & specific electric loading	

UNIT - II	**Design Of Transformer.**	**(08 Hours)**
	Output equation with usual notations, design of core, yoke and windings of transformer. Estimation of resistance and leakage reactance of transformer. Estimation of no-load current, regulation of transformers. Calculation of mechanical forces, methods of cooling & tank design. Design of small single phase transformers.	
UNIT - III	**Design of 3-Φ Induction Motors.**	**(07 Hours)**
	General Specifications of 3-Φ Induction Motor. Stator winding design, Stator slot design, Stator teeth design, Depth of stator core, Rotor design: Air gap length, squirrel cage rotor and wound rotor, Design of rotor teeth & rotor core, Estimation of operating characteristics, Dispersion Coefficient.	
UNIT - IV	**Design of 1-Φ Induction Motors.**	**(07 Hours)**
	Design of single phase Induction motor: Choice of specific loadings. Determination of main dimensions. Relative size of three phase and single phase Induction motor for same output. Design of main and starting winding for split phase, capacitor start motors. Design of rotor. Operating characteristics.	
UNIT - V	**Design of DC & Synchronous Machines.**	**(08 Hours)**
	Design of DC Machines: Design of field system and interpoles. Design of armature. Design of commutator and brushes. Design of heating coil, motor resistance starter, regulators, lifting magnets. **Alternators:** Output equation, Main dimensions, Choice of specific electric and magnetic loadings, choice of speed and number of poles, different types of pole structure used in synchronous machines. Design of armature: conductors, slots. Armature winding, Design of air-gap, Design of rotor: Height of pole, pole shoe, damper winding. open circuit characteristics, Losses and temperature rise.	
UNIT - VI	**Modern Tools for Machine Design.**	**(08 Hours)**
	Design optimization using various FEA (Finite Element Analysis) based machine design packages- Maxwell 2D, 3D, Magnet, 2D FEA analysis. FEMM (Finite Element Method Magnetics) free software.	

Industrial Visit: Industrial visit to a manufacturing unit of transformer or Induction motor.
Term Work:
The term work shall consist of 3 Drawing sheets and Design problems. (three in AutoCAD)
1. Details (Elevation, side view, top view) and assembly of 3- phase (power or distribution) transformer with design report. 2. Details and layout of AC & DC winding with design report. 3. Assembly of 3- phase induction motor.(only sheet) 4. Report based on Industrial visit to a manufacturing unit. (Transformer or Induction motor). 5. Details and assembly of 3-phase Alternator with design report. 6. Assembly of 1- phase transformer. 7. Details and assembly of 3- phase Induction Motor with design report. 8. Assembly of 1- phase Induction Motor.
Text Books:
1. Sawhney A. K., *Electrical Machine Design,* Dhanpath Rai & Co. (P) Ltd Sixth Edition: 2006
2. M.G. Say – Theory and Performance and Design of A.C. Machines, 3rd Edition, ELBS London.
3. P. P. Silvester and Ferraris's book on Electrical Machine Design using FEA
Reference Books:
1. A Shanmugasundaram, G. Gangadharan, R. Palani, - Electrical Machine Design Data Book, 3rd Edition, 3rd Reprint 1988 - Wiely Eastern Ltd., - New Delhi
2. K.L. Narang , A Text Book of Electrical Engineering Drawings, Reprint Edition : 1993 / 94 – Satya Prakashan, New Delhi.
3. Vishnu Murti, "Computer Aided Design for Electrical Machines", B.S. Publications

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments

1. Students should compile the list of vendors (manufacturers of Transformers, DC Machines, Single phase Induction Motors, PMDC motor, Stepper Motor, contact, and address) along with the details like types, specifications, and costs and should prepare the comparative for the same.
2. Students should prepare the report on "Estimation of no-load current of transformer" or "Estimation of operating characteristics of 3-Φ Induction Motor".
3. One industrial visit to the Manufacturing industry and the students will prepare the report which includes the consumption pattern of the products produced, process flow diagram and process description, major engineering problems in the industry.
4. Students should prepare the plant-layout for the industry visited.

5. Watch the NPTEL video on this subject of any TWO modules and summarize it
6. Solve Design problems for all types of machines.
7. Students should prepare the Datasheet for different machines.
8. Open book class test (Objective test).
9. Students have to study any One NPTEL videos related to a particular unit in group and prepare/present power point presentation.
10. Visit to Winding workshops, any machine repairing shop and prepare a report on detailed specifications of a machine, construction, types, material used and applications.
11. Students should prepare the report on modern tools in Design of Machines.
12. Prepare models for any types of machines related to the subject and write industrial applications.

Electrical Estimation, Costing & Installation

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Introduction of Electrical supply system, typical A.C. power supply scheme, Classification of Supply systems
2.	Single line diagram of electrical supply system

Course Objectives:

1. To understand the basic concepts, installation, estimation and costing of distribution systems, substation and residential electrification.
2. To enable candidate to understand earthing system for residential and commercial Installation.
3. To understand practical aspects of condition monitoring and maintenance of various electrical equipments

Course Outcomes: Student will be able to

1.	Draft tender documents.
2.	Do estimation and costing of residential and commercial buildings.
3.	Select appropriate method for service connection.
4	Calculate total electrical load.
5.	Do detail Estimation and costing of industrial installation.

UNIT - I	**Contracts, Tenders And IE Rules**	**(06 Hours)**
	Concept of Contracts and Tenders, Types of Contracts and Contractors, types of tenders, tender notice, procedure for submission and opening of tenders ,requirements of valid contract and good Contractor, comparative statements for selection of contractors, IE rules related to electrical installation, work to permit.	
UNIT - II	**Service Connections**	**(06 Hours)**
	Concept of service connections, types of service connections and their features, methods of installation of service connections, difference between underground and over head service connections, service connections for 11KV HT consumers, panel designing, cable jointing.	
UNIT - III	**Electrification Of Residential Installation**	**(06 Hours)**
	General rules and guidelines for installation of residential electrification and positioning of equipments, calculation of total electrical load in the residential installation, procedure for the design of number of sub circuits, load calculations and selection of size of wire by considering overload and future expansion, determine length of batten and length of wire, selection of rating for main switch, distribution board, MCB, ELCB	

	and wiring accessories, total estimation and costing of overall residential installation with proper cost of material, labor charges	
UNIT-IV	**Electrification Of Commercial Installation**	**(06 Hours)**
	Concept of commercial installation, difference between residential and commercial installation ,types of cables required for commercial installations according to size and core ,general requirements and selection factors for commercial installation, load calculations and selection of size of service connections and nature of supply, decide number of lighting and power sub circuits as per IE rules, decide length of wire required for every sub circuit, decide ratings of wiring accessories, main switch, bus bar MCB,ELCB etc. Decide proper method of earthing for commercial installation find out the estimation chart with proper cost of material,cost of labor, contingencies charges and profit margin.	
UNIT - V	**Electrification Of Industrial Installation**	**(06 Hours)**
	Concept of motor wiring circuit and single line diagram, guidelines about power wiring and motor wiring, design considerations of electrical installations in industry/factory/workshop, machine current calculations ,selection of size of wires, cables required for the machines and its controlling unit, decide length and size of cable required for every industrial load, decide ratings of wiring accessories, main switch, bus bar MCB,ELCB etc. for every industrial load, decide proper method of earthing for industrial installation with their costing, find out the estimation chart with proper cost of material, cost of labor, contingencies charges and profit charges and profit margin.	
UNIT - VI	**Maintenance**	**(06 Hours)**
	Definition, Need of maintenance, Types of maintenance, Breakdown maintenance, Preventive maintenance, Condition monitoring, Advanced tools and techniques of condition monitoring, Maintenance strategy, Maintenance type selection, Comparison of different maintenance types,	

Text Books:

4. Surjit Singh – "Electrical Estimating and Costing" Dhanpat Rai Publications

Reference Books:

1. S. L. Uppal - "Electrical wiring, estimating & costing" Khanna Publishers
2. B. V. S. Rao - "Operation and Maintenance of electrical equipments" (Vol. 2) Media promoters and publishers Pvt. Ltd.
3. Raina.K.B and Bhattacharya S.K.,"Electrical design,Estimating and Costing",Tata McGraw Hill,NewDelhi
4. B.D. Arora-Electrical wiring,Estimation and costing-New Heights,New Delhi

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. To solve numerical on calculations of total electrical load in the residential installation.

2. To solve numerical on calculations of total electrical load in commercial installation.

3. To solve numerical on calculations of total electrical load in industrial installation.

4.To calculate the total electrical load of electrical machine laboratory/any building.

5. To solve two years question papers of University unit wise.

6. To collect information about the recent/new installation techniques.

7. To observe and study the earthing system of our collage & to prepare a report on the earthing system which is used.

Elective I: Engineering Economics and Accountancy

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamental of Electrical Engineering Economics

Course Objectives:

- This course will introduce various concepts and methods of economic analysis in engineering, including the time value of money and its effect on economic decisions, economic equivalence, economic measures of worth, cash flow analysis, equipment depreciation, effects of taxation and inflation, decision making under uncertainty, capital budgeting, replacement decisions, and benefit-cost analysis.

Course Outcomes:

The student will be able to

1.	Understand the economic fundamentals.
2.	Learn about principles of decision making involved in engineering projects.
3.	They learn about: cash flows, time value of money and evaluation of investments and projects.

UNIT - I	**Introduction** Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.	**(06 Hours)**
UNIT - II	**Demand & Supply Analysis** Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.	**(06 Hours)**
UNIT - III	**Production And Cost Functions** Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function.	**(06 Hours)**
UNIT - IV	**Cost Analysis** Cost Concepts - Cost function – Types of Cost - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.	**(06 Hours)**

UNIT - V	**Pricing**	**(06 Hours)**
	Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice – role of Government in pricing control.	
UNIT - IV	**Financial Accounting (Elementary Treatment)**	**(06 Hours)**
	Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements - Analysis & Interpretation of financial statements. Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.	

Assignment:

1. Managerial Economics - Relationship with other disciplines
2. Demand and supply Analysis
3. Production and cost function
4. Cost analysis
5. Pricing
6. Financial accounting

Text Books:

1.McGuigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.

2. Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.

Reference Books:

1. Samuelson. Paul A and Nordhaus W.D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.

2. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
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3. Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson South Western, 4th Edition, 2001.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Elective I: Six Sigma

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Computer Programming

Course Objectives:

1. To explore the concept of six sigma thoroughly.
2. The actual working of six sigma in industries.
3. Various terms related with six sigma.
4. The outcome and analysis of six and sigma.

Course Outcomes: The students will be able to

1.	Recognize the six sigma organization and concepts of six sigma matrix.
2.	Explore the six sigma administration
3.	Explore the Basic Quality Tools & Statistical concepts related with six sigma.
4.	Explore the Capability Analysis Process capability indices.
5.	Explicit the concept of DFSS.
6.	Explore the various concepts regarding objectives and benefits of SPC and Lean Principles.

UNIT - I	**Introduction of Six Sigma Origin of Six Sigma & Basic concept**	**(06 Hours)**
	Six Sigma Overview:-Recognize why organizations use Six Sigma, how they apply its philosophy of Value Focus and goals. Concepts of CTQ / CTP / Y=f(X) **Six Sigma Metrics**:-Recognize key drivers for business (profit, market share, customer satisfaction, efficiency, product differentiation) and how key metrics and scorecards are developed and impact the entire organization. Calculate process performance metrics such as defects per unit (DPU), rolled throughput yield (RTY), cost of poor quality (COPQ), defects per million opportunities (DPMO) & sigma levels	
UNIT - II	**Six Sigma Administration**	**(06 Hours)**
	Describe the project selection process, Six Sigma improvement methodology (DMAIC). Six Sigma and other team roles and responsibilities, Describe and define the roles and responsibilities of participants on Six Sigma and others including Black Belt, Master Black Belt, Green Belt, Champion, executive, coach, facilitator, team member, sponsor, process owner. **Voice Of Customer** Use various methods to collect customer feedback (e.g., surveys, focus groups, interviews, observation) and identify the key elements that make these tools effective. Review survey questions to eliminate bias, vagueness, etc. Define Internal & External Customers,	

	DEFINE Project charter, Stake-holders, Project Team dynamics	
UNIT - III	**Basic Project Management & Planning Tools**	**(06 Hours)**
	Describe Process Mapping, SIPOC/COPIS, process inputs, outputs. Design and process failure mode and effects analysis (DFMEA & PFMEA). Basic Tools:- 1) Affinity Diagrams, 2) Interrelationship Digraphs, 3) Tree Diagrams, 4) Prioritization Matrices, 5) Matrix Diagrams, 6) Process Decision Program (PDPC) Charts, 7) Activity Network Diagrams. Quality function deployment (QFD), **Basic Quality Tools & Statistical concepts** Graphical, Enumerative Tools, Population parameters and sample statistics. Data Types, Measurement scales, Sampling Techniques, Data collection tools - Check Sheets, Stratification. Data Analysis Tools - Pareto diagram, Cause & Effect analysis, Trend Charts, Multi-Vary analysis, Scatter Diagrams, Histogram & Control Charts. Basic Probability Concepts, Measures of Distribution, Dispersion and Central Tendency, Probability distributions - Discrete data - Binomial &Poisson. Continuous data - Normal distribution. Z transform, Central Limit Theorem. Student's t distribution & Chi square distribution.	
UNIT - IV	**Capability Analysis Process capability indices**	**(06 Hours)**
	- Short term - Process Capability - Cp, Cpk. Long Term - Process performance indices - Pp, Ppk. Confidence IntervalsCI for Means & for Variance. Hypothesis Testing ANOVA & Regression One Way &Multiway ANOA, Co-relation & Regression analysis MSA Bias, Linearity, Stability and precision/tolerance (P/T) ratio for Continuous data & Percent agreement for Discrete Data. Calculate, analyze, and interpret measurement system capability using repeatability and reproducibility (GR&R) for continuous data. Kappa agreement concepts for Discrete data.	
UNIT - V	**DFSS Concepts**	**(06 Hours)**
	DMADV (define, measure, analyze, design, verify) and IDOV (identify, design, optimize, verify), Robust Design Concept. **Experimental Methods** Introduction to Design of Experiments	
UNIT - VI	**Control Methods**	**(06 Hours)**
	Describe the objectives and benefits of SPC, including controlling process performance, identifying special and common causes, Rational sub-grouping, Control Charts for Continuous & Discrete data. **Lean Principles** Define and describe concepts such as Theory of Constraints, value chain, flow, pull, etc., and tools commonly used to eliminate waste, including kaizen, 5S, error-proofing, value-stream mapping, etc. Value-added and non-value-added activities Identify waste in terms of excess inventory, space, test inspection, rework, transportation, storage, etc., and reduce cycle time to improve throughput.	

Text Books:	
1. The Six Sigma Black Belt Handbook by MacCarty, Daniels, Bremer and Gupta, TMGH, 2010 Edition Juran Institute's Six Sigma Breakthrough and Beyond by De Feo and Barnard, TMGH.What is Six Sigma? by Peter Pande, TMGH	
2. Six Sigma Management by Blashka, TMGH	
3. All about Six Sigma by Warren Brussee, TMGH	
Reference Books:	
1. Lean Six Sigma by Hubert Ramprasad, Sara Books Pvt.Ltd.	
2. The Certified Six Sigma Black Belt Hand Book, Donald Benbow, Pearson	
3. The Certified Six Sigma Black Belt Hand Book, Donald Benbow, Pearson	
4. Achieving Business Excellence by Pravin Rajpal, Om Books International, India.	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments: Assignments should be able to verify course outcome and skills of group work, communication skills

1. To solve numerical on block diagram reduction to calculate overall transfer function of system and verify with Mason's gain formula
2. To calculate transfer function of equivalent electrical system for given mechanical system.
3. Quiz –Multiple Choice Questions 20
4. To solve numerical on time domain and analyze parameter variations on transient response and steady state error.
5. Solve two years question paper of Pune university unit wise.
6. Solve two years question paper of GATE unit wise.
7. To observe NPTEL video lecture by M. Gopal on any topic of control and give presentations, group discussion.
8. To collect information about controllers used in process control in thermal power plant.
9. To collect information about controllers used in power system for voltage and frequency control.
10. To collect information about controllers used in machine control.
11. To validate the design by hardware.

Elective- I Risk and Derivatives

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	

Course Prerequisites:

The students should have knowledge of

1.	Management Studies

Course Objectives:

1. To explore the concept of Risk and Derivatives thoroughly.
2. The actual working of Risk and Derivatives in industries.
3. Various terms related with Risk and Derivatives.

Course Outcomes: After learning this course the students will be able to

1.	Explore the various terms related with derivatives
2.	Explore the various contracts related with the future.
3.	Explore the term options and various terms associated with options
4.	Explore the term SWAPS and terms associated with SWAPS.
5.	Explore to the meaning of risk management and associated terms .
6.	Explore with various Instruments of External techniques of Risk Management

UNIT I	**Derivatives**	**(06 Hours)**
	Definition and TypesForward Contracts, Futures Contracts, Options, Swaps, Differences between Cash and Future Markets, Types of Traders ,OTC and Exchange Traded Securities, Types of Settlement, Uses and Advantages of Derivatives, Evolution of Derivatives Market in India, Regulations – Framework, Exchange Trading in Derivatives	
UNIT II	**Futures Contract**	**(06 Hours)**
	Specifications of Futures Contract, Margin Requirements, Marking to Market, , Hedging using Futures, Types of Futures Contracts – Securities, Stock Index Futures, Currencies and Commodities, Delivery Options, Relationship between Future Prices, Forward Prices and Future Spot Prices, Commodity Futures, Contract Terminology and Specifications for Stock Options and Index Options in NSE, Contract Terminology and specifications for Stock Futures and Index futures in NSE, Contract Terminology and Specifications for Interest Rate Derivatives.	
UNIT III	**Options**	**(06 Hours)**
	Meaning and Definition, Exchange Traded Options, OTC Options – Specifications of Options, Call and put Options, American and European	

	Options, Intrinsic Value and Time Value of Options, Option payoff options on Securities, Stock Indices, Currencies and Futures, Options pricing models Differences between Future and Option contracts	
UNIT IV	**SWAPS**	**(06 Hours)**
	Definition of SWAP, Interest Rate SWAP, Currency SWAP, Role of Financial Intermediary, Warehousing, Valuation of Interest rate SWAPs and Currency SWAPs Bonds and FRNs	
UNIT V	**Introduction to Risk Management**	**(06 Hours)**
	Identifying types of risks, Management of Translation, Transaction and economic Exposure, Quantifying Risk and Hedging techniques, Internal and External Techniques viz Netting, Matching, Leading and Lagging, Price variation, Short Term borrowing, Pricing in Foreign Currency, Assets Liability Management	
UNIT VI	**Instruments of External techniques of Risk Management**	**(06 Hours)**
	Forwards, Futures, Swaps, Options, Forward Rate Agreement, Caps, Collars, Floors and their applications, Pricing techniques, Operational aspects.	

Text Books:

1. Derivatives simplified – An Introduction to Risk Management- P.Vijaya Bhaskar & B.Mahapatra

Reference Books:

4. Options and Futures- Hull

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments: Assignments should be able to verify course outcome and skills of group work, communication skills

1. To solve numerical on derivatives
2. Quiz –Multiple Choice Questions 20
3. Solve two years question paper of Pune university unit wise.
4. Solve two years question paper of GATE unit wise.
5. To observe NPTEL video lecture on any topic of control and give presentations, group discussion.
6. Case study on risk management related with any factory or commercial industry.

Elective I: Total Quality Management

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Power Quality Management

Course Objectives:

1.	To introduce the fundamental concepts of total quality management, statistical process control, six sigma and the application of these concepts.
2.	To introduce philosophies and strategies to quality related issues.
3.	To provide skills in diagnosing and analyzing problems causing variation in manufacturing and service industry processes.
4.	To provide a basic understanding of "widely-used" quality analysis tools and techniques.

Course Outcomes:

The student will be able to

1.	Develop an understanding on quality management philosophies and frameworks
2.	Develop in-depth knowledge on various tools and techniques of quality management
3.	Learn the applications of quality tools and techniques in both manufacturing and service industry.

UNIT - I	**Quality, Strategic Planning, and Competitive Advantages**	**(06 Hours)**
	Brief History - Definitions of Quality. Quality in Manufacturing and Service Systems. Quality and Price - Quality and Market Share - Quality and Cost - Quality & Competitive Advantage.	
UNIT - II	**Principles of Total Quality Management:**	**(06 Hours)**
	Introduction - Elements of Total Quality Management - Malcolm Baldrige National Quality Award Criteria. Benefits of Total Quality Management. The Deming Management Philosophy – The Juran Philosophy – The Crosby Philosophy	
UNIT - III	**Customer Focus :**	**(06 Hours)**
	The Customer-Driven Quality Cycle - Quality Function Deployment –Customer Satisfaction Measurement Techniques - Customer Relationship Management Techniques.	
UNIT - IV	**TQM Tools & Techniques (I)**	**(06 Hours)**

	The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.	
UNIT - V	**TQM Tools & Techniques (Ii)**	**(06 Hours)**
	Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.	
UNIT - VI	**Quality Systems**	**(06 Hours)**
	Need for ISO 9000-2008 quality system – elements, documentation, quality auditing- as 9000 –ISO 14000 – concepts, requirements and benefits – case studies of TQM implementation in manufacturing and service sectors.	

Assignment:

1. Quality , strategic Planning and competitive Advantages
2. Principles of total quality management
3. Customer Focus :
4. TQM tools and techniques (I)
5. TQM Tools & Techniques (II)
6. Quality Systems

Text Books:

1. Total Quality Management – Sundarrajan
2, Quality Control & Total Quality Management – Jain
3.Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia,3rd Edition, Indian Reprint (2006).

Reference Books:

1.James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2.Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 200UNIT III
3.Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4.Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Elective I: New Enterprise Creation and Management

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Progressive Skills

Course Objectives:

1.	Develop an understanding of the importance of entrepreneurship in society and the different forms of entrepreneurial activity
2.	Develop an understanding of the new venture creation process and the life cycle of a new venture from idea development and launch through growth and various exit strategies
3.	Gain knowledge of business plans, sources of capital, marketing and distribution strategies, operations, organization issues, as well as key legal and ethical considerations affecting entrepreneurial ventures

Course Outcomes:

The student will be able to

1.	Develop your analytical skills: thinking, problem solving, and decision-making
2.	Learn to analyze and critically evaluate ideas and viewpoints
3.	Acquire an interest in learning more by questioning and seeking answers
4.	Learn to find and use resources to answer your questions
5.	Learn to form conclusions and recommendations and to support them with logic and Evidence.

UNIT - I	**Foundations of Entrepreneurship Development:**	**(06 Hours)**
	Concept and Need of Entrepreneurship Development Definition of Entrepreneur, Entrepreneurship, Innovation, Invention, Creativity, Business Idea, Opportunities through change. Concepts of Entrepreneur, Manager, Entrepreneur / Corporate Entrepreneur –Comparative study - Roles, Responsibilities, Career opportunities. Entrepreneurship as a career, Entrepreneurship as a style of management, The changing role of the entrepreneur: mid-career dilemmas – Closing the window: Sustaining Competitiveness - Maintaining competitive advantage.	

UNIT - II	**Theories of Entrepreneurship**:	**(06 Hours)**
	Innovation Theory by Schumpeter & Imitating Theory of High Achievement by McClelland X-Efficiency Theory by Leibenstein Theory of Profit by Knight Theory of Social change by Everett Hagen	
UNIT - III	**Influences on Entrepreneurship Development :**	**(06 Hours)**
	Entrepreneurial Traits, External Influences on Entrepreneurship Development: Socio-Cultural, Political, Economic, Personal. Entrepreneurial culture with special reference to Entrepreneurship / Corporate Entrepreneurship. Entrepreneurial Success and Failure: Reasons and Remedies.	
UNIT - IV	**Women Entrepreneurs and Business Planning Process**	**(06 Hours)**
	Women Entrepreneurs: Challenges to Woman Entrepreneurs, Achievements of Woman Entrepreneurs, Role Models of Woman Entrepreneurs. **Business Planning Process** - The business plan as an entrepreneurial tool Elements of Business Plan, Objectives, Market Analysis, Development of Product / idea, Marketing, Finance, Organization & Management, Ownership, Critical risk contingencies of the proposal, Scheduling and milestones.	
UNIT - V	**Creating Entrepreneurial Venture**	**(06) Hours)**
	Entrepreneurship Development Cycle Entrepreneurship Development and Government. Role of Central Government and State Government in promoting Entrepreneurship with various incentives, subsidies, grants etc. – with special reference to 'Export oriented unites' Role of the following agencies in the Entrepreneurship Development DIC – District Industrial Center SISI – Small Industries Services Institute EDII – Entrepreneurship Development Institute of India NIESBUD – National Institute of Entrepreneurship and Small Business Development NEDB – National Entrepreneurship Development Board	
UNIT - VI	**Project Management**	**(06 Hours)**
	Technical, Financial, Marketing Personnel and Management feasibility Reports Financial schemes offered by various financial institutions like Commercial Banks, IDBI, ICICI, SIDBI, SFCs, Venture Capital Funding, Angle Capitalist Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.	

Assignment:

1. Foundation of entrepreneurship development
2. Theories of entrepreneurship
3. Influence pf entrepreneurship development
4. Women Entrepreneurs and Business Planning Process
5. Creating Entrepreneurial Venture
6. Project management

Text Books:	
1. Dynamics of Entrepreneurship Development – Vasant Desai.	
2.Entrepreneurship Development New Venture Creation – Satish Taneja, S.L.Gupta ***3.*** Entrepreneurship and Small Business Management – Siropolis	
Reference Books:	
1. Project management – K. Nagarajan.	
2. Corporate Entrepreneurship – Vijay Sathe	
3. New Vistas of Entrepreneurship: Challenges & Opportunities – A. Sahay, M.S.Chhikara	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Elective I: Operational Research

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Basics about literature reviews and surveys.

Course Objectives:

1. The objective of this course is to help the students acquire quantitative tools, and use these tools for the analysis and solution of business problems.
2. The emphasis will be on the concepts and application rather than derivations.

Course Outcomes:

The student will be able to learn

1. Methods for making decisions
2. Analyzing the outcome of events
3. Mining and analyzing data using statistics
4. Programming methods
5. Problem-solving and organization
6. Computing algorithms

UNIT – I	**Quantitative Techniques and Operations Research**	**(06 Hours)**
	Meaning, Scope of Quantitative Techniques and Operations Research in Management, Advantages and Limitations of Quantitative Techniques ,OR Models	
UNIT – II	**Linear Programming**	**(06 Hours)**
	Meaning of Linear .Programming, General Mathematical Formulation of LPP, Graphical Analysis, Simplex Method, Two-phase Method, Big M-Method. Duality and Post Optimality Analysis Advantage and Limitations of LPP.	
UNIT - III	**Transportation Model**	**(06 Hours)**
	Mathematical Formulation, Initial Basic Feasible Solution, Vogel's Approximation Method, Optimization (Minimization and Maximization) Using Modified Distribution Method and Stepping Stone Method.	

UNIT - IV	**Dynamic Programming**	**(06 Hours)**
	Nature of Dynamic Programming Problem, Dynamic Programming Solutions for Knap Sack, Traveling Salesman (Stage Coach), Assignment of Salesmen to Sales Area and Capital Budgeting. Integer linear programming: Meaning, Application, integer programming algorithm (branch and bound algorithm, cutting plan algorithm).	
UNIT – V	**Waiting Line Models and Replacement Models**	**(06 Hours)**
	Introduction, Scope in Management Decisions, Queuing Models M/M/1 (Infinite and Finite Population), Probability Calculations arid Application of M/M/C (Infinite Population) Introduction Scope in Management, Single Equipment Replacement Model and Group Replacement.	
UNIT - VI	**Game Theory & Markov Chain Analysis**	**(06 Hours)**
	Introduction to Games, Maximin and Minimax Principles, Pure and Mixed Strategies, Solution of Games Using-Algebraic and Graphical Methods. Computation of Sequential Probability of States for Different Periods, Steady State Probability of States and Application of Markov Chain.	

Assignment:

1. Quantitative Techniques and Operations Research
2. Linear Programming
3. Transportation Model
4. Dynamic Programming
5. Waiting Line Models and Replacement Models
6. Game Theory & Markov Chain Analysis

Text Books:

1. Hamdy A.Taha, **Operations Research: An Introduction**, Pearson 2008
2. H.M. Wagner, **Principles of Operations Research with Application to Managerial Decisions,** PHI Learning. 2nd Ed., 2009.
3.Chawla, **Operation Research**, Kalyani Publication Ludhiyana,2009

Reference Books:

1.V. K. Kapoor, **Problems and Solutions in Operations Research,** New Delhi, Suitan Chand and Sons, 2001
2. F. Hillier, **Introduction to Operation Research**, TMH, 2005
3. Bobby Srinivasan and C.L. Sandblom, **Quantitative Analysis for Business Decisions,** Singapore, McGraw Hill Publications, 2001.
4. C.R. Kothari, An Introduction to **Operational Research ,** New Delhi, Vikas Publications, 3rd Ed., 2009.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Name of subject: Engineering Mathematics-IV (Optional Subject)

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of

1.	Determinants
2.	Matrices
3.	Differentiation
4.	Integration of functions
5.	Differential equation

Course Objectives:

	The course aims at making the students familiar about the most basic numerical methods and Concepts like error estimation helpful in various fields of engineering and can be used to simulate the results of various numerical methods.

Course Outcomes:

The student should be able to

1.	Derive appropriate numerical methods to solve algebraic and transcendental equations
2.	Evaluate the accuracy of common numerical methods.
3.	Develop appropriate numerical methods to solve a difference equation.
4.	Be familiar with numerical interpolation and approximation of functions, numerical integration and differentiation.
5.	Be familiar with numerical solution of ordinary differential equations.
6.	To compute Numerical Solution of Partial Differential Equations.

UNIT - I	**Numerical solutions of algebraic and transcendental equations**	**(08 Hours)**
	Bisection method, Regula-Falsi method, Newton-Raphson method, Direct iterative method.	
UNIT - II	**Solution of system of linear algebraic equation**	**(08 Hours)**
	Matrix inversion method, Gauss- elimination Method, Jordan's method, Crout's method. Gauss-Seidel and Gauss Jacobi's iterative method.	
UNIT - III	**Difference equation and Solution of difference equations**	**(08 Hours)**
	Definition of difference equations, formation of difference equation. Solution of Homogeneous and non-homogeneous difference equation with constant and variable coefficients using Boole's operator method and generating functions. Simultaneous difference equation.	
UNIT - IV	**Interpolation and Numerical differentiation and integration**	**(08 Hours)**
	Finite difference operator, Interpolation formula with equal and unequal intervals. Divided differences and central differences. Curve fitting: Method of least squares. Straight line, Second degree, parabola, Exponential curve.	

	Differentiation using forward, backward and divided difference General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule.	
UNIT - V	**Numerical solution of I order ordinary differential equation**	**(08 Hours)**
	Solution by Euler's, method Euler' Modified method Taylor's series. Runga-kutta method. Milne's Predictors and Correctors method.	
UNIT - VI	**Numerical Solution of Partial Differential Equations**	**(08 Hours)**
	Classification of second order partial differential equations, Solution of Laplace's, Poisson's, heat and wave equations by finite difference methods, Use of method of characteristics for solution of initial and boundary value problems.	

Text Books:

1.Gupta P.P.& Malik G.S., *Calculus of Finite Differences and Numerical Analysis*, Krishna Prakashan Mandir,Meerut, 21/e, 2006.

2. B.S.Grewal, *Engineering Mathematics*, Khanna Publishers, 12/e, 2006.

Reference Books:

1. Francis J. Scheid, Schaum's *Outline of Numerical Analysis*, McGraw-Hill, New York, 1989.
2. S. S. Sastry, *Engineering Mathematics*, Vol I, II Prentice Hall Publication, 3/e, 2004.
3. C.Ray Wylie & Louis C. Barretle, Advanced Engineering Mathematics, Tata McGraw Hill Publishing Co Ltd., 6/e,2003.

Syllabus for Unit Test:

Unit Test -1	UNIT – I,II,III
Unit Test -2	UNIT – IV,V,VI

Switchgear And Protection

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral : 25 Marks	01 Credit

Course Pre-requisites:

The Students should have knowledge of

- Generation, Transmission & distribution of electrical energy.

Course Objectives:

- To develop the students to identify, analyze & to understand the fundamentals, classification, application and selection of various switchgears and different protection schemes of power system components.

Course Outcomes: The students will be able to

1. Elaborate construction and working principle of different types of Circuit interrupting devices & to compute fault levels.
2. Describe the need of protective Relaying and operating principles of different types of relays.
3. Study different type of faults in transformer, alternator, I.M. and various protective schemes related to them.
4. Learn transmission line protection schemes, and characteristics of different types of distance relays.
5. Learn over voltage protection schemes, and different neutral earthings.
6. Learn substation layouts and PC applications in short circuit studies for designing relaying scheme

UNIT – I	**Fundamentals of power system protection & Circuit interrupting devices.**	**(06 Hrs.)**
	Fundamentals of power system protection: Functions of protective system, Normal and abnormal conditions and their effects on power system, Fault-types, Causes, Essential qualities of protections, Short circuit kVA calculations, and Current limiting reactors. **Circuit interrupting devices:** Arc formation process, Methods of arc extinction, important terms - re-striking and recovery voltage RRRV. Construction, working & application of low tension switchgear - Fuses, Isolators, MCB, MCCB, ELCB, Contactor, ACB. Construction, working & application of low tension switchgear: - OCB, MOCB, SF6 CB, VCB. Rating of circuit Breaker, Resistance switching and current chopping, capacitive current breaking, auto re-closures. Introduction to HVDC circuit breaking.	
UNIT – II	**Protective Relaying**	**(06 Hrs.)**
	Evolution of protective relaying, classification of relays, zones of protection, primary and backup protection, essential qualities of protective relaying. Trip circuit of circuit breaker. Various basic operating principles of protection- over current, (current graded & time graded),directional over current, differential, distance, induction type	

	relay, torque equation in induction type relay, current and time setting in induction relay, Numerical on TSM, PSM and operating time of relay. **Static & Digital Relaying** Overview of Static relay, block diagram, operating principal, merits & demerits of static relay. Numerical Relays :-Introduction, Block diagram of numerical relay, Sampling theorem, Anti –Aliasing Filter, Block diagram of Phasor Measurement Unit *(*PMU).	
UNIT–III	**Protection of Power System Components**	**(06 Hrs.)**
	Protection of Alternator & Transformer Various faults in Alternator, abnormal operating conditions, protection against stator faults, Protection against rotor faults, protection against loss of excitation and loss of prime mover. **Protection of Transformer :** Types of faults in transformer. Percentage differential protection in transformers, Restricted E/F protection. Incipient faults, Buchholz relay. Protection against over fluxing. Protection against inrush current **3 Phase Induction Motor Protection-** Abnormal conditions & causes of failures in 3 phase Induction motor, single phasing protection, Overload protection, Short circuit protection.	
UNIT–IV	**Protection of Busbar & Transmission Line**	**(06 Hrs.)**
	Bus bar Protection: Differential protection of bus bars. Selection of C.T. ratios for bus bar protection. High impedance differential relay. **Transmission line**: over current protection for feeder using directional &non-directional over current relays, Introduction to distance protection, impedance relay, reactance relay, mho relay & Quadrilateral Relays, Introduction to PLCC, block diagram, advantages, disadvantages, three stepped distance protection, Effect of arc resistance, and power swing on performance of distance relay. Realization of distance relays (impedance, reactance and mho relay) using numerical relaying algorithm (flowchart, block diagram), Introduction to Wide Area Measurement (WAM) system.	
UNIT – V	**Over voltage protection & System grounding**	**(06 Hrs.)**
	Over voltage protection : Overvoltage, causes of overvoltage, Lightning phenomenon, direct & indirect strokes, protection of overhead transmission lines from direct lightning strokes, Lightning arresters, rod gap type, horn gap type, Thyrite type, Metal oxide (ZnO) type lightning arrester. **System grounding:** Introduction and importance of earthing, terms and definitions, types of earthing, substation earthing.	
UNIT-VI	**Substation layouts & PC applications in short circuit studies for designing relaying scheme :**	**(06 Hrs.)**
	Substation layouts : Classification of substation, selection & location of site, main connection schemes, Equipments used in substation, various symbols – C.B. , L.A., fuses, relays, power transformer, bus bar and its arrangement, CT.- PT, isolators, earthing switch, capacitor bank, batteries PLCC, control room, etc., Connection diagram and its layout. **PC applications in short circuit studies for designing relaying scheme:** Introduction, Types of faults, and Assumptions for conducting short circuit studies,	

	steps in development of algorithm.	

Term Work:

The Practical's shall consist of record of minimum eight experiments.

1. To find the characteristics of MCB using relay testing kit.
2. To find the characteristics of MCCB using relay testing kit.
3. To find the characteristics of Fuse using relay testing kit.
4. To find the pickup and drop off voltage of Contactor
5. To find the characteristics of Induction type over current relay
6. To find the characteristics of Induction type under voltage relay
7. To find the characteristics of microprocessor based over current relay
8. To find the characteristics of microprocessor based under voltage relay
9. To find the characteristics of microprocessor based over voltage relay
10. Differential protection of 3 phase alternator.
11. Protection of transmission line.
12. Report on industrial visit to switchgear training centre /or switchgear/relay manufacturing unit/ or H.T. substation visit.

Text Books:

1. S. Rao, "Switchgear Protection & Power Systems", Khanna Publications
2. Y. G. Paithankar, S. R. Bhide, "Fundamentals of Power System Protection", Prentice Hall of India
3. Bhavesh Bhalja, R.P. Maheshwari, N.G. Chothani," Protection and Switchgear", Oxford University Press, 2011 Edition.
4. A Course in Electrical power – M L Soni, P V Gupta, U S Bhatanagar - Dhanpat Rai and sons

Reference Books:

5. Badri Ram, D. N. Vishwakarma, "Power System Protection & Switchgear", Tata McGraw Hill Publishing Co. Ltd.
6. J. Lewis Blackburn , Thomas J. Domin, "Protective Relaying: Principles and Applications", Fourth Edition, CRC Press.
7. Prof. Dr S.A. Soman, IIT Mumbai , A Web course on "Digital Protection of power System" http://www.cdeep.iitb.ac.in/nptel/Electrical%20Engineering/Power%20System%20Protection/Course_home_L27.html
8. A.G. Phadke and J.S. Thorp , Computer relaying for Power System, Research Studies Press LTD, England.(John Willy & Sons Inc New York)
9. Crussel Mason, "The Art and Science of Protective Relaying", Wiley Eastern Limited.
10. Power system Protection and Switchgear – B Ravindranath and M M Chander – Wilsey Eastern Ltd.
11. L. P. Singh, Digital Protection, New age international Publisher

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. Market survey for various switchgear devices and prepare report on the same.
2. Industrial visits to Manufacturer of switchgear devices and prepare report.
3. Solve 3 University exam question papers.
4. Prepare report on NPTEL Video lectures on any topic related with syllabus.

5. Solved the unsolved questions from books for every Unit.
6. Solve the GATE question papers Unit wise.
7. Prepare self-study report on topics related with Units.

Power System Analysis		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	TW: 25Marks Practical:25 Marks	01 Credit

Course Pre-requisites:	
The Students should have knowledge of	
1.	Structure of Power System, Transmission &Distribution Systems, Network Analysis.
Course Objectives:	
	This course aims at understanding the components of interconnected power system, Representation of these system components in terms of mathematical models and Tools for analyzing the system operation during the normal & abnormal operating conditions.
Course Outcomes:	
1.	To apply the concepts of Complex Power.
2.	To interpret Single Line Diagram of power systems & model the power system in per unit
3.	To formulate the load flow problem for 3-4 bus system &interpret the results.
4	To compute fault current on the occurrence of symmetrical fault on power system
5	To covert the unbalanced system parameters to sequence components & vice a versa& to compute fault current on the occurrence of SLG,LL and DLG fault on power system
6	To Derive swing Equation & apply solution to understand the rotor dynamics of synchronous machines

UNIT - I	**Complex Power**	**(08Hour)**
	Structure of Interconnected & Integrated Power System, Formation of National Grid, Present Indian Power Industry, Power system analysis and their necessity. Concept of complex power , Complex power flow through transmission lines, Load on the system, its composition, nature of load curves for various consumer categories, Load voltage-frequency specifications & permissible variations, Real power-frequency and reactive power- voltage dependency, Conventional methods of voltage control of Power system.	
UNIT - II	**Power System Modeling**	**(08Hour)**
	Representation of power system-Single line diagram, Representation and modeling of long line, Synchronous generator-simple model such as emf behind reactance, power transformer, three winding transformer. Impendence and Reactance diagrams of power systems and their use. The per unit system of parameter value representation-selection of base, change of base, advantages, its application to impendence/reactance diagram.	
UNIT - III	**Load Flow Analysis**	**(08Hour)**
	Development of mathematical models of simple systems by network reduction, Driving point & Transfer Admittance, Concept of Z-bus and Y-	

	bus matrices, Formation of Y Bus Matrix ,Introduction to load flow analysis, Classification of buses, Formation of power flow equations (PFES) for n bus power system, Classification of variables& solution techniques, Newton-Raphson Method(Polar form) for load flow solution ,Introduction to optimal power flow and DC power flow, its importance, necessity and difference from conventional power flow.	
UNIT - IV	**Symmetrical Fault Analysis**	**(08Hour)**
	Symmetrical faults on power system, Sudden three [phase short circuit fault on unloaded alternator, Sub-transient, transient and steady state currents and impedances, DC offset and effect of the instant of short circuit on the waveforms, Estimation of fault currents with and without pre-fault current for simple power system, Selection of circuit breakers and current limiting reactors.	
UNIT - V	**Unsymmetrical Fault Analysis**	**(08Hour)**
	Methods of symmetrical components, relationships, sequence impedances. Representation of power systems by positive, negative and zero sequence networks, Nature of sequence impedance of power system components. Line-Line, Line-Ground, Line-Line-Ground faults, Analysis of unloaded and pre loaded alternators and simple power systems with and without fault impedance.	
UNIT - VI	**Power System Stability**	**(08Hour)**
	Concept of steady state, dynamic and transient stability of power systems and the factors controlling each, Steady state stability, its evaluation and variation of limits of stability under system conditions, Transient stability and importance of rotating machine dynamics in the power system stability evaluation,. The swing equitation, its derivation, Equal Area Criteria (Consideration of one machine-infinite bus problem only.)	

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Study of effect of VAR compensation on receiving end voltage profile on a transmission line using capacitor bank.
2. Determination of steady state stability limit for transmission line.
3. Determination of steady state limit of a synchronous motor and plotting P-δ curve.
4. Measurement of sub transient reactance of a salient pole synchronous machine by Static impedance /Dalton – Cameron method.
5. Measurement of negative sequence reactance of synchronous machine.
6. Measurement of zero sequence reactance of synchronous machine.
7. Fault analysis for symmetrical fault by simulation or AC/DC network analyzer.
8. Unsymmetrical fault analysis by simulation or AC/DC network analyzer.
9. Computer aided solution of 3 bus load flow problem using Gauss-Seidel method.
10. Formation of Y bus matrix using computer programming.
11. Study of load flow on 3 bus system using by actual simulation/ AC network analyzer.

Text Books:

1. I J Nagrath , D P Kothari,"Modern Power System Analysis",Tata McGraw Hill Publication
2. Grainger Jhon J, W D Stevenson Jr,"Power System Analysis" Mc-Graw Hill Publication

Reference Books:	
1. O I Elgerd, "Electrical Energy Systems Theory: An Introduction", Tata McGraw Hill Publication	
2. Hadi Sadat," Power Sysem Analysis", McGraw Hill International Publication	
3. A R Bergen and Vijay Vittal,"Power System Analysis", Pearson Education Asia.	
4. J D Glover and M Sarma," Power System Analysis & Design",	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. Refer the following web sites& prepare presentation on Power Scenario of India

   Ministry of Power, CERC, MNRE

2. Sketch the load curves for Residential, Industrial, Agriculture, Municipal and Commercial categories of consumers and compare them with reference to Load factor, Diversity factor. Also plot the monthly load curve of the college substation. Estimate the maximum demand, Load factor.
3. Sketch the single line diagram (SLD) of the college & department power supply system. Enter all the specifications of the power system components & develop SLD using the ETAP software.
4. Develop the power system model of the department/College power system/any other power system (up to 50 buses) & conduct the load flow analysis using E TAP software. Analyse the results using N-R method.
5. Develop the power system model of the department/College power system/any other power system (up to 50 buses) & conduct the short circuit analysis using E TAP software. Analyse the results to confirm the Circuit Breaker ratings.
6. Develop the model of long transmission line and synchronous machine & estimate the steady state stability limit using ETAP/MATLAB software.
7. Self-learn NPTEL sessions on i) Symmetrical Fault Analysis ii) Unsymmetrical Fault Analysis & Generate presentation to explain the concepts: i) Nature of Short Circuit Current ii) Selection of Circuit Breakers iii) Symmetrical components
8. Arrange Industrial Visit to Load Dispatch Center: Prepare Study Report on Control Functions applied by the load dispatcher for Power System Analysis

Modern Control Systems

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral 25marks	01 Credit

Course Prerequisites:

The students should have knowledge of

Linear control system , methods of stability analysis, Matrix algebra, Z transform,

Course Objectives:

This course introduces state space modeling and stability analysis of system. It includes phase plane and describing function method of stability analysis of nonlinear system. It also introduces fundamental mathematical concepts and stability analysis of digital control system

Course Outcomes: After learning this course the students will be able to

1.	Represent the system equation in various state space models (physical, phase variable, canonical
2.	Draw block diagram and signal flow graph from state space model of system.
3.	Calculate the solution of state equation; calculate transfer function from state space model.
4	Recognize various nonlinearities and its effect on system stability
5	Compare between Linear and nonlinear, analog and digital, state space and transfer function model
6	Calculate pulse transfer function of digital system. Explain the mathematical model of digital system and select appropriate sampling frequency.
7	Describe principle of operation and applications of adaptive control, robust control and Artificial neural network, Fuzzy logic .

UNIT I	**State Variable representation**	**(08Hours)**
	Comparison of transfer function and state variable analysis, concept of state, state space, state vector, state equation of the system, state space representation using physical variable, phase variable and canonical variables with block diagram, Decomposition of transfer function, Eigen values and Eigen Vectors, Diagonalization of the system matrix with distinct and repeated roots.	
UNIT II	**State variable stability analysis and design**	**(08Hours)**
	Solution of state equation with and without inputs, State Transition Matrix (STM), Methods to determine STM using Infinite series method ,Laplace transform, Caley Hamilton theorem. Definition of controllability, observability, Kalman's test, Gilbert's test, Determination of transfer	

	functions from state model. State feedback control, pole placement design through state feed back	
UNIT III	**Nonlinear system**	**(08Hours)**
	Different types of nonlinearities, peculiar behavior of nonlinear system-response, jump resonance, limit cycle: stable and unstable, amplitude as function of frequency oscillation, nonlinear spring mass system, sub harmonic oscillation, asynchronous quenching, frequency Phase plane method, singular points, phase plane plots using delta method determination stability from state trajectory, relation with time domain analysis. Concept of Describing Function, derivation of describing function of various nonlinear elements, Stability analysis using describing function, existence of limit cycle, Merits demerits of describing function method	
UNIT IV	**Discrete time system**	**(08Hours)**
	Basic elements of discrete data system, merits of discrete system, Sampling and selection of sampling period, Sample and hold circuit, A/D and D/A converter, modeling of zero order hold , reconstruction of signals from samples, Shannon's sampling theorem. Z transform – definition, simple functions, Inverse Z transform, linear difference equations and their solution	
UNIT V	**Analysis of Discrete time system**	**(08Hours)**
	Derivation of Pulse Transfer function, , pulse transfer function of closed loop system, Bilinear transformation, stability in Z plane, Jury's test, Routh's criteria , State space representation of discrete time systems, state space models from pulsed transfer function.	
UNIT VI	**Introduction to advances in control system**	**(08Hours)**
	Adaptive control , Model reference Adaptive control block diagram and working with practical applications, Robust control ,Fuzzy logic , Artificial neural network, algorithm and learning architecture	

Term Work:

The term work shall consist of record of minimum eight experiments .To ensure that at least one experiment on each unit.

1. To convert transfer function into state model i) phase variable form ii) canonical form
2. To derive state model of DC servo motor from physical variables and observe step response, i.e. to solve state equation of DC servo motor
3. To determine Eigen values, Eigen vectors and diagonalises the system.
4. To determine controllability and observability by Kalman's test and Gilbert's test.
5. Design of state feedback gain matrix by pole placement.
6. To plot phase plane trajectory of system with nonlinear elements using SIMULINK.
7. To analyze stability of nonlinear system using describing function.
8. To convert continuous time system to discrete time system and to observe effect of sampling time on step response.
9. To determine the gain for stability in Z domain.

10. To study adaptive control and robust control applications with MATLAB demos.	
Text Books:	
4. I.J. Nagrath, M. Gopal, ""Control System Engineering", New Age International Publishers – Fourth edition	
5. Katsuhiko Ogata, "Digital control system", Prentice Hall, 2010.	
6. M.Gopal , " Digital control system"	
7. Dorf and Bishop , "Modern Control systems"- Pearson education	
Reference Books:	
5. Nise N. S. "Control Systems Engineering", John Wiley & Sons, Incorporated, 2011	
6. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005	
7. Dorf, Bishop - "Modern control system", Pearson Education	
8. M. N. Bandyopadhyay, "Control Engineering – Theory and Practice", Prentice Hall of India Ltd. Delhi	
9. Geir E. Dullered, F.G.Paganini - " A course in robust control theory "- Springer	
10. Jan Jan tzen- 'Foundation of Fuzzy control – a practical apporaoch – Wiley	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. To solve numerical on decomposition of transfer function to state variable (different forms)and to draw state diagram
1. To identify state variables of physical system and write down state model.
2. To determine transfer function from given state model
3. To calculate STM by three different methods.
4. To derive describing function of different nonlinearities
5. To draw phase plane trajectory by isoclines method
6. To derive pulse transfer function
7. To prepare comparative analysis of discrete time and continuous time system.
8. To prepare chart of Z transform of standard functions
9. To solve question papers of GATE unit wise.
10. To study Research paper on adaptive control and prepare presentation.
11. To observe NPTEL video on robust control and group discussion related to it.

Industrial Organization & Management

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The Students should have knowledge of Professional skill development 1 to 5.

Course Objectives:

- This course will help the students to understand the basic operations in any organization.
- With the technical skill sets, there are also some more things that to be studied to be in any organization.
- This course will help the students to learn these aspects. They are going to learn about Management related terms like Depreciation, Replacement engineering, Product Engineering, Production Planning and Inventory Control.
- This course will also help to understand the Job Evaluation techniques, Personnel Management, Behavioral Aspects of Management and Operations Research.
- This course will complete the overall aspects of the student with technical knowledge with needed management skills.

Course Outcomes:

The student will be able to

1.	Explore the basic terms related to management like function, principles. Leadership qualities will also get improved.
2.	Explore the type of companies and the various financial aspects related with the company.
3.	Exculpate the terms related with the depreciation, replacement and products of the company and to deal with it.
4	Explore the production and inventory related terms. The control on the inventory and information related with it.
5	Explore the company's requirement as per the human resource requirement, which also very important part in any company.
6	Behaviors and ethics of an employee in the organization are to be studied which will be requiring in carrying out the operations research.

UNIT - I	**Management**	**(06 Hrs)**
	Introduction, Phases in Management: scientific management, Behavioral management and Information technology and operations research. Industrial Management, Contents and Principle of Management, Functions of Management: Planning, coordination, motivation and control. Leadership: Qualities of leader, Leading Process. Education and Training of Management. Elements of Quality Management System ISO 9001-2008.	

UNIT - II	**Formation of Company and Financial Planning**	**(06 Hrs)**
	Introduction, Company definition, Types of company Structure: Proprietorship, Partnership, Joint Stock companies, Limited and Unlimited Company, Private and Public, Corporative, Public, Private and Joint Sector, Trust and Holding Companies. Classification of Capital, Capital Procurement, Structure of Authorized Pattern, Economic Aspects of Cost Patterns, Breakeven Analysis, Financial Management.	
UNIT - III	**Depreciation, Replacement and Product Engineering**	**(06 Hrs)**
	Introduction, objective of Business Enterprise, Depreciation and Depreciation Calculation, Estimation of Life of an Engineering Aspects, Replacement of Plant and Machinery, Product Classification, Initiation of Product, Production Analysis, simplifications and Standardization, Product Research, Diversification and specialization, Patent Analysis.	
UNIT - IV	**Production Planning and Inventory Control**	**(06 Hrs)**
	Introduction, Production System, Production Types, Production Planning functions, Efficiency of Production planning and Drawing Office Organization. Inventory Control Functions, Procedures for Purchase, Principles of Inventory Control, Inventory Policies, Economic Batch Quantities, Purification of Inventory, control of incoming materials and store Issues. Information flow analysis.	
UNIT - V	**Job Evaluation and Personnel Management**	**(06 Hrs)**
	Introduction, Job Evaluations and Analysis, Classification of Job evaluation techniques, Evaluation of wages structures, system of merit rating, measurement of responsibility and wage incentives. Importance of personnel management, human relations, attitude of employers towards employees. Functions of personnel management. Personnel research, labour participation in management. Labour turnover, industrial disputes.	
UNIT - VI	**Behavioral Aspects of Management and Operations Research**	**(06 Hrs)**
	Scientific management, Hawthorne Studies, Elton Mayo, Theory X and Theory Y, Hertzberg's motivation and Hygiene Theory, Organizational goals and Culture. Stresses at workplace, Interpersonal Behavior, power and Politics in organization. Phases of an Operations Research, formation of some typical problems, competitive model, Program Evaluation and Review Techniques, Graphical and Matrix solution of linear programming models.	

Assignment:

1. Introduction to management
2. Formation of Company and Financial Planning
3. Depreciation, Replacement and Product Engineering
4. Production Planning and Inventory Control
5. Job Evaluation and Personnel Management
6. Behavioral Aspects of Management and Operations Research

Text Books:

1. "Industrial Organization and Management", S. K. Basu, K. C. Sahu, B. Rajiv, PHI learning Private Limited, New Delhi.

2. "Industrial Engineering and Management", O.P. Khanna, Dhanpat Rai & Sons. New Delhi.

Reference Books:
1. **“**Industrial Organization and Management: Principles and Practice**”,** S. Sundaramurthy, R. V. R. Sivagnanam, United Book Corporation.
2. **“**Industrial Organization and Management Fundamentals**”,**Herman B. Henderson, Albert E. Haas Industrial Press.
3. “Professional Management in Industrial Organisations”, K.P. Kaur, Deep and Deep Publications.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective II: Renewable Energy Systems

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01 Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamentals of Electrical Engineering, Power Generation Techniques

Course Objectives:

1.	To create awareness of renewable energy sources like wind, solar energy, biogas plant, mini-hydro plant and fuel cell
2.	To impart knowledge of biogas plant, tidal energy, wave energy, ocean thermal and geothermal energy
3.	To impart knowledge of energy storage and hybrid systems.

Course Outcomes:

	Students are able to
1.	Uses renewable energy sources
2.	Utilize wind energy
3.	Apply solar energy to any equipment
4	Describe biogas plant, mini-hydro plant and fuel cell
5.	Compare tidal energy, wave energy, ocean thermal and geothermal energy
6.	Decide energy storage and hybrid systems for particular application

UNIT - I	**Energy scenario**	**(06 Hours)**
	Classification of energy sources, energy needs of India and energy consumption patterns, worldwide potential of these sources, energy efficiency and energy security, energy economics, energy conservation supply curves, Environmental issues, environmental impacts, global warming and climate change, carbon trading, concept of carbon credits, carbon footprints, carbon dioxide sequestration, atmospheric pollutants, Kyoto protocol, ozone depletion. Concept of clean development CDM and prototype carbon funds PCF. Impacts of renewable energy, Factors favoring and against renewable energy sources. Market survey, International electro technical commission standards for renewable energy sources.	

UNIT - II	**Wind energy systems**	**(06 Hours)**
	Types of wind turbines, electrical generators for wind turbines, power in the wind, impact of tower height, measurement of wind speed, maximum rotor efficiency, various controls in wind turbines, fixed speed and variable speed wind turbines, power converters, wind turbine economics, specific wind turbine performance calculations, impacts of wind turbines. Wind turbine specification, stand alone and grid connected wind turbines, offshore wind farm, magnetic levitated wind turbine, floating wind turbine, wind turbines on vessels, installation, maintenance and commissioning of wind turbines. wind turbine system market survey, design, layout, costing, grid integration issues, case studies, data analysis, numericals	
UNIT - III	**The solar resource and solar thermal systems**	**(06 Hours)**
	The solar spectrum, the earth's orbit, altitude angle of the sun at solar noon, solar position at any time of day, sun path diagrams for shading analysis, solar time and civil (clock) time, clear sky direct-beam radiation, total clear sky insolation on a collecting surface, monthly clear-sky insolation, solar radiation measurements, average monthly insolation. Direct and diffused radiation and effect on power generation. Solar thermal water heating, types of collectors, efficiency, solar thermal energy generation. Applications of solar thermal system, solar ponds, solar cooker, issues in solar energy, case studies, data analysis, system design, layout, costing, numericals	
UNIT - IV	**Solar photovoltaic systems**	**(06 Hours)**
	Basic semiconductor physics, a generic photovoltaic cell, the simplest equivalent circuit for a photovoltaic cell from cells to modules to arrays, the P-V I-V curve under standard test conditions (STC), impacts of temperature and insolation on i–v curves, shading impacts on i–v curves, crystalline silicon technologies, single-crystal czochralski (CZ) silicon, ribbon silicon technologies, cast multi-crystalline silicon, crystalline silicon modules, thin-film photovoltaic, efficiency of PV system. Methods of measurements. : introduction to the major photovoltaic system types, current–voltage curves for loads, grid-connected systems: interfacing with the utility, dc and ac rated power, the "peak-hours" approach to estimating PV performance, capacity factors for PV grid-connected systems, stand-alone PV systems, concentrating solar power (CSP) technologies,PV-powered water pumping, building integrated solar systems, solar facades, solar cars, PV systems – off grid systems and scope for inclusive growth of rural India. Grid autonomy. Bi-directions metering. maximum power point tracking,Calculation of system details. Grid integration issues, case	

	studies, data analysis, grid-connected PV system economics, system trade-offs, dollar-per-watt ambiguities, amortizing costs, grid connected and standalone system sizing, design, layout, costing, payback period,numericals	
UNIT - V	**Other sustainable energy sources and hybrid systems**	**(06 Hours)**
	Micro-turbine generation, wave energy conversion systems, tidal energy conversion systems, ocean thermal energy systems, clean coal power plants, biogas, biomass to electrical energy conversion, gasifires, biomass fired boilers, co-firing, cogeneration in sugar industry, energy from municipal solid waste, geo-thermal energy, biomechanical energy, bio-chemical and photosynthesis techniques. Biomass for electricity, small hydro, mini hydro, micro-hydropower, pico hydro,nano hydro systems, electricity from water pipelines, fuel cells, fuel cell efficiency, types of fuel cells, hydrogen production, standalone system,hybrid systems, wind solar hybrid, wind diesel, solar diesel, wind mini hydro hybrid system, numericals	
UNIT - VI	**Energy storage**	**(06 Hours)**
	Battery storage, charge regulators, battery types, maintenance, management, fly wheel energy storage, pumped water energy storage, hydrogen energy storage, super capacitor energy storage systems, compressed air energy storage systems, cryogenic energy storage, thermal energy storage, seasonal thermal energy storage. Use of various energy storage techniques in renewable energy sources, numericals	

Term Work:

1. Fabrication of solar over.
2. Fabrication of solar cooker.
3. Desalination of water using solar still.
4. Fabrication of solar car.
5. Fabrication of solar updraft tower.
6.Fabrication of small horizontal axis wind turbine and testing.
7. Fabrication of small vertical axis wind turbine and testing.
8. Fabrication of small biogas plant.
9. Fabrication of a simple fuel cell.
10. Fabrication of small hydro turbine.
11. Testing of super capacitor.
12. Comparison of performance of wind turbine with and without flywheel.

Text Books:

1. G. D. Rai, “Non-Conventional Energy Sources”,Khanna Publication
2. R. Ramesh, “ Renewable energy Technologies”,Narosa Publication
3. S. Rao, Dr. B. B. Parulekar, “Energy Technology – Non Conventional, Renewable and Conventional”,Khanna Publication
4. Mittal, “ Non-conventional systems ”,Wheelers publication

5. Gilbert M. Masters, “Renewable and Efficient Electrical Power Systems”, Wiley -IEEE Press, August 2004

Reference Books

1. Dr. S. P. Sukhatme, “Solar Energy”, Tata McGraw Hills
2. S. Bandopadhyay, “Solar Energy”, Universal publishing.
3. Paul Gipe, “Wind Energy Comes of Age”, John Wiley & Sons Inc.
4. Njenkins, “Wind energy technology”, John wiley and sons
5. Mcniels, Frenkel , Desai , “Solar and wind energy technologies”, Wiley Eastern
6. G. N. Tiwari, SangeetaSuneja, “Solar Thermal Engineering Systems”,Narosa Publishing House
7. L. L. Freris, “Wind Energy Conversion System”, Prentice Hall
8. Mukund Patel, “ Wind and solar systems”, CRC press
9. TapanBhattachary, “Solar photovoltaics for terrestrials
10. MiliMajumdar, “Energy Efficient Buildings in India”, Published by Tata Energy Research Institute & MNRE
11. Thomas Ackermann, “Wind Power in Power Systems”, Wiley Publications
12. Tony Burton et al, “Wind Energy Hand Book”, John Wiley & Sons Inc.
13. Siegfried Heier, Rachel Waddington, “Grid Integration of Wind Energy Conversion Systems”, Wiley Publications

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments

1. Market survey for solar thermal system for water heating and solar photo voltaic system for power generation. Collection of information charts brochures / leaflets from suppliers, manufacturers, cost, technical specification etc. comparative tables for techno commercial information of various products from various companies. List of solar power plants in India and nearby Pune city

2. Clean development mechanism CDM, Carbon credit, carbon credit certificate, types of Carbon Credits, carbon footprints, Measuring carbon footprints, Average carbon emissions per person by country

3. Various wind generators and their comparison w.r.t techno commercial information, their suitability to grid and standalone system, suitability of installation

4. Design of water pumping system for irrigation purpose using wind energy system with a 5 hp pump. Design of suitable water storage facility and drip irrigation system. Size of storage tank. Detailed design with required techno commercial information, turbine size, tower size, cost, market survey for procurement.
5. Design of solar thermal system for hot water system for Bharati Vidyapeeth College of engineering hostel and guest house. The report should involve all techno-commercial

information. Complete design of solar thermal system. Block diagram and detailed diagram of plant for installation and costing. List of suitable vendors for procurement of raw material also should be available in the report with their detailed address, phone numbers, website and email-ID.

6. Design of solar Photovoltaic system for water pumping system for Bharati Vidyapeeth College of engineering campus. The report should involve all techno-commercial information. Complete design of photovoltaic system. Block diagram and detailed diagram of plant for installation and costing. List of suitable vendors for procurement of raw material also should be available in the report with their detailed address, phone numbers, website and email id.

7. Detailed report for grid integration and challenges in grid integration. Recent trends in grid integration. Methods of grid integration for solar and wind power plants. Detailed report.

8. Design of Canteen waste management system for Bharati Vidyapeeth College of engineering canteen with detailed report for feasibility of biogas plant for cooking in canteen and possibility of generation of electricity. The report should involve all techno-commercial information. Complete design of biogas plant for canteen waste. Block diagram and detailed diagram of plant for installation and costing. List of suitable vendors for procurement of raw material also should be available in the report with their detailed address, phone numbers, website and email id.

9. Design of fuel cells for a PMPML bus with all techno commercial information.

10. Design of Solid waste management for katraj area, Pune city, system design and detailed report with all techno commercial information and layout.

11. Design of micro hydro power plant for canal and piped drinking water at parwati pumping station with all techno commercial information and layout.

12. Design of nano hydro system for electrical energy generation system using kinetic energy of water through pipes in a large housing r society with suitable energy storage and illumination system using LED for parking of the society.

13. Types of storage systems for electrical energy. The storage systems suitable for wind energy, solar energy should be given. All other new unconventional methods of storage of energy along with conventional methods should be explained. e.g. super capacitors, compressed air storage, pumped water storage, hydrogen energy storage etc. Techno-commercial comparison all methods should be done. Actual sites where these methods are used should also be mentioned.

14. Industrial visit report for a renewable energy power plant.

Note : - Each practical needs power point presentation and detailed report with techno-commercial information.

Elective II: Programmable Logic Controllers

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Logic gates operations, Boolean algebra, Data types (integer, float, unsigned)

Course Objectives:

	This course aims at understanding the basic concepts PLC hardware and PLC software and Programming language like ladder, construction of ladder diagram, their symbol and component of the instruction. Knowledge of analog and digital input and Output devices, PID, SCADA and Communication Protocols.

Course Outcomes:

1.	Describe Programmable Logic Controller along with the block diagram with its components in detail.
2.	Develop architecture of SCADA explaining each unit in detail.
3.	Develop a software program using modern engineering tools and technique for PLC and SCADA.
4	Enlist various industrial applications using PLC and SCADA.
5	Describe the importance of SCADA in critical infrastructure.
6	Execute, debug and test the programs developed for digital and analog operations.

UNIT -I	**Introduction to PLC**	**(06 Hours)**
	History of PLC, PLC system, Block Diagram of general PLC, PLC input and output module, Sensors and actuators for PLC, Central Processing Unit, Monitors, solid state memory, Power supplies, HMI and Interfaces, Selection criteria for PLC, PLC advantages and disadvantages, Present PLC manufacturers.	
UNIT – II	**Programming of PLC**	**(06 Hours)**
	Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, Programming equipments, Introduction of Programming languages, Basic components & symbols in ladder diagram, Construction of PLC ladder diagram for programming, Fundamentals of ladder diagram, Boolean logic & relay logic, programming ON/OFF Inputs to produce ON/OFF outputs.	
UNIT – III	**PLC Applications**	**(06 Hours)**
	Analog PLC operation, PID control of continuous processes, closed loop systems and common problems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface. Industrial process example: Motors Controls - AC Motor starter, AC	

	motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive. Temperature, level and Flow control.	
UNIT - IV	**SCADA Systems Overview**	**(06 Hours)**
	Introduction and definitions of SCADA, Principles of SCADA systems, SCADA system evolution. Basic SCADA system Architecture: Human Machine Interface, Master Terminal Unit, Remote Terminal Unit. SCADA data transfer through PLCC. Communication Technologies, Communication system components, SCADA Communication in an electrical power system. SCADA system desirable Properties, Real Time System, SCADA server, SCADA functions.	
UNIT - V	**SCADA Architecture**	**(06 Hours)**
	First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture, Intelligent Electronic Devices. Operation and control of interconnected power system, Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, State estimation, and SCADA system security issues overview. SCADA systems in the critical Infrastructure: Conventional Electric Power Generation, water Purification System, Chemical Plant, Petroleum Refining Process.	
UNIT - VI	**The Evolution Protocols**	**(06 Hours)**
	Overview of Open systems interconnection (OSI) Model, Functions of OSI Model Layers, OSI Protocols, Functions of Transmission control protocol / Internet protocol (TCP/IP) Layers, TCP/IP protocol, DNP3 protocol, IEC layered architecture, Ethernet/IP, Process Field bus (Profibus), Modbus, The Security Implications of the SCADA protocols.	

Term Work:

The term work shall consist of record of minimum eight experiments. Four from first 6 and four from next 6 out of given below.

1. Interfacing of lamp & button with PLC for ON & OFF operation. Verify all logic gates.
2. Performed delayed operation of lamp by using push button.
3. UP/DOWN counter with RESET instruction.
4. Combination of counter & timer for lamp ON/OFF operation.
5. Set / Reset operation: one push button for ON & other push button for OFF operation.
6. DOL starter & star delta starter operation by using PLC.
7. PLC interfaced with HMI& status read/command transfer operation.
8. Parameter reading of PLC interface with SCADA.
9. Alarm annunciation using PLC &SCADA.
10. Tank level control by using PLC &SCADA.
11. Temperature monitoring by using PLC &SCADA.
12. Reporting & trending in SCADA system.

Assignments:

1. Automation requirement in industries
2. Recent trends in automation
3. Basic concepts in Ladder diagrams
4. Basic programming for automation
5. A solar panels automatic tracking system based on PLC
6. Automated water supply control system using PLC
7. PID implementation of heating tank in industrial plant
8. PLC based SCADA for oil storage
9. Web based remote access laboratory using SCADA
10. Three layer PLC/SCADA system architecture in process automation

Text Books:

3. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers.
4. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI

Learning, New Delhi, 5thEdition.

5. Ronald L. Krutz, "Securing SCADA System", Wiley Publications.
6. Wiley Boltan

Reference Books:

5. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition
6. Gordan Clark, Deem Reynders, "Practical Modern SCADA Protocols", ELSEVIER
7. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications
8. Krishna Kant, "Computer Based Industrial Control", PHI
9. Catalogues and user manuals PLC and SCADA

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective II: Signal and Systems

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01 Credit

Course Pre-Requisites:

The Students should have

1.	Mathematics
2.	Physics
3.	Fundamentals of Electrical Engineering

Course Objectives:

	The course introduces fundamental concepts of signals,.

Course Outcomes:

1.	Understand and apply knowledge of various types of signals
2.	Understand and apply knowledge of Fourier analysis to signals
3.	Understand and apply knowledge of Laplace transforms in Analysis of CT systems .
4.	Understand and apply fundamental concepts of DTFT
5.	Understand and apply the Z transform analysis
6.	Understand and apply the concept of Fourier and Laplace to real time applications

UNIT - I	**CLASSIFICATION OF SIGNALS AND SYSTEMS.**	**(06 Hours)**
	Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & A periodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems- Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal &No causal, Stable & Unstable	
UNIT - II	**ANALYSIS OF CONTINUOUS TIME SIGNALS**	**(06 Hours)**
	Fourier series analysis-spectrum of Continuous Time (CT) signals-Fourier and Laplace Transforms in CT Signal Analysis - Properties.	
UNIT - III	**LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS**	**(06 Hours)**
	Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis of CT systems .	
UNIT - IV	**ANALYSIS OF DISCRETE TIME SIGNALS**	**(06 Hours)**
	Baseband Sampling - DTFT – Properties of DTFT - Z Transform – Properties of Z Transform	
UNIT - V	**LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS**	**(06 Hours)**
	Difference Equations-Block diagram representation-Impulse response - Convolution sum- Discrete Fourier and Z Transform Analysis of	

	Recursive & Non-Recursive systems	
UNIT - VI	**Real Life Application presentations**	**(06 Hours)**
	Analysis of obstacle detection, Speech and hearing, applications of Fourier Transform, Neuro Electronics, Automation for Smart traffic controller, Image processing, CDMA, Speaker verification, Pattern recognition in forex rates, Use of signals in SETI, SAS in radio astronomy, SAS in economic analysis, SAS in meteorology, SAS in Fourier optics	

Term Work:
1. Generation of Signals: continuous time and discrete time
2. Convolution of Signals, Solution of Difference equations
3. Fourier series representation of continuous time signals
4. Fourier transform of continuous time signals.
5. Discrete time Fourier analysis
6. Introduction to SIMULINK and calculation of output of systems represented by block
7. Sampling and reconstruction of continuous time signals
Text Books:
1) 'Signals and systems' by Rajiv Kapadia, Jaico Publishing
2) 'Signals and systems' by Anand Kumar
3) 'Linear Systems and signals' by B.P.Lathi
4) Textbook on Signals and systems' by Harish Parthasarathy, I.K.International Publishing
Reference Books:
1. 'Signals and systems' by Allen Openheim and Wilsky, Prentice Hall Publication
2. Schaum's outline series book on 'Signals and systems'by H.Hsu and R.Ranjan

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. Solve the unsolved question from the books Unit wise.
2. Prepare report from NPTEL video lectures.
3. Prepare programming assignments from the syllabus topic.
4. Solve the University Question Papers Unit wise.
5. Group Discussions from syllabus topics from students and prepare report on the same.
6. Topics preparation from students on any topics and prepare PPT on the same.

Elective II: Introduction to JAVA and .NET

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Object Oriented Programming like C++ and Internet concepts

Course Objectives:

	To expose students to the programming in JAVA and .NET for basic level programming so that they can program static and dynamic web pages using JAVA and .NET platforms.

Course Outcomes: After learning the subject students will be able to

1.	Use basic JAVA programming using JDK
2.	Construct JAVA programs and applications deployed on server with server components and communication
3.	Develop JAVA platform applications with database connectivity for dynamic and static web pages
4	Use basics of .NET platform programming using .NET technologies
5	Construct web applications using .NET technologies involving server communication and front end
6	Use .NET platform for building applications using web services

UNIT - I	**Introduction to JAVA**	**(06 Hours)**
	Why Java, Java Virtual Machine (JVM), Features, Variables, Data Types, Operators, Control Statements, Object Oriented Concepts in Java, Libraries, Packages,	
UNIT – II	**Server Programming Concepts in JAVA**	**(06 Hours)**
	Java Development Kit (JDK), Exception Handling (try-catch, throws and finally), Java API, Compile and Runtime Environment, JAVA – J2EE, JAVA.awt - Applets, JAVA GUI Components, Java Scripting	
UNIT – III	**Database and Application Programming Concepts in JAVA**	**(06 Hours)**
	Java Beans, Web Servers, Servelets, HTTP Request and Response, JDBC, Accessing Database from JSP Page, Exploring JAVA Programs and Applications	
UNIT – IV	**Introduction to .NET**	**(06 Hours)**
	Introduction to .NET Framework, Evolution of .NET technologies - CTS, CLS, CLR, MSIL, Introduction to Base Class Library, Introduction to VB.NET - Working with Visual Studio IDÉE – IDE Components, VB.NET Fundamentals – Variables, Data Types, Control Flow Statements, Subroutines, Functions, Object Oriented Concepts in .NET	

UNIT - V	**Building Applications with .NET**	**(06 Hours)**
	.NET Class Library, Input and Output, Windows Forms, Building Forms, Responding to User Inputs/Events, Menu Design, Information Presentation, Dialog Control, Working with XML, GUI's	
UNIT - VI	**Advanced .NET and Applications**	**(06 Hours)**
	ADO.NET Architecture, Web Programming, Web Services, Database Controls, ADO .NET Programming, Exploring .NET Applications and Programs, Comparison Between J2EE and .NET	

Term Work :

The term work / assignments shall consist of record of topics from the list given below.

1. Development of static pages using HTML of an online Departmental Store having home page, login page and items catalog page.
2. Add validations to above static pages of home page, login and items page using Java Script.
3. Creation of a XML document of 20 students. Add their roll numbers, marks obtained in 5 subjects, total and percentage and save this XML document at the server. Write a program that takes students' roll number as an input and returns the students' marks, total and percentage by taking the students' information from the XML document on server.
4. Creation of a JavaBeans which gives converted value of Temperature (in degree Celsius) into equivalent Fahrenheit.
5. Do the assignment using JSP by converting the static web pages of assignment 2 into dynamic web pages. Create database with User Information and Item information. The Item catalog should be dynamically loaded from the database.
6. Implementation of "Hello World!" program using JSP Struts Framework.
7. Repeat all / some of the above experiments using VB.NET.

Text Books:

1. Achyut Godbole and Atul Kahate, " Web Technologies - TCP/IP Architecture and Java Programming"
2. Matha "Core Java: A comprehensive Study" Publisher PHI
3. Black, "Web Technologies – HTML, JavaScript, PHP, JAVA, JSP, ASP.NET, XML and AJAX", Wiley India
4. Pro ADO.NET with VB.NET – Sahil Mailk and Paul Dickinson
5. Programming with JAVA - E Balgurusamy
6. N.P .Gopalan, J.Akileneshwari, "Web Technology-A developer's Perspective", PHI

Reference Books:

1. Complete Reference J2EE – Jim Keogh
2. McDonald, "ASP .Net Complete Reference", TMH
3. Online Java Developer Tutorials and Training: http://www.oracle.com/technetwork/java
4. H.M. Deitel and P.J. Deitel, "Java™ How to Program", Prentice-Hall of India, Seventh edition

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Assignments:

1. Solve the unsolved question from the books Unit wise.
2. Prepare report from NPTEL video lectures.
3. Prepare programming assignments from the syllabus topic.
4. Industrial visit to software company for the learning the applications of JAVA and .NET.
5. Solve the University Question Papers Unit wise.
6. Group Discussions from syllabus topics from students and prepare report on the same.

Elective II: Special Purpose Machines

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Electrical machines (AC and DC)

Course Objectives:

	To expose students to construction, principle of operation, performance and applications of special electrical machines as an extension to the study of basic electrical machines.

Course Outcomes: After learning the subject students will be able to

1.	Use the MMF and EMF equations for rotating machines
2.	Analyze, perform basic experiments and can apply use of BLDC and PMSM motors for different applications
3.	Analyze, perform basic experiments and can apply use of SRM and SYNREL motors for different applications
4	Analyze, perform basic experiments and can apply use of Linear Induction Motors and Traction Motors for different applications
5	Analyze, perform basic experiments and can apply use of Transverse Flux - Axial Flux machines and PMSG and DFIG Generators for different applications
6	Analyze, perform basic experiments and can apply use of small control motors like servo motors, stepper motors, universal motors and PCB motors for different applications

UNIT - I	**Generalized Machine Theory**	**(06 Hours)**
	Energy in singly excited magnetic field systems, Magnetic force and torque from energy, Magnetic force and torque from co-energy, Forces and torques in systems with permanent magnets, Magnetic field production of EMFs in rotating machines	
UNIT – II	**Permanent Magnet Special Motors**	**(06 Hours)**
	Types, Construction, Principle of Operation, Characteristics, Drives / Control and Applications of – 1. Brushless DC Motor (BLDC) 2. PM Synchronous Motor (PMSM)	
UNIT – III	**Reluctance Type Special Motor**	**(06 Hours)**
	Types, Construction, Principle of operation, Characteristics, Drives / Control and Applications of – Reluctance Motor – includes 1. Switched Reluctance Motors (SRM) 2. Synchronous Reluctance (SYNREL) Motors	

UNIT – IV	**Linear and Traction Motors**	**(06 Hours)**
	Types, Construction, Principle of Operation, Characteristics, Drives / Control and Applications of – 1. Linear Induction Motor (LIM) 2. Traction Motors	
UNIT - V	**Transverse Flux & Axial Flux Machines and Special Generators**	**(06 Hours)**
	Types, Construction, Principle of Operation, Characteristics, Drives / Control and Applications of – 1. Axial Flux Permanent Magnet (PM) Synchronous Generators 2. Doubly Fed Induction Generators (DFIG) 3. Transverse Flux Machines	
UNIT - VI	**Control of Small Special Motors**	**(06 Hours)**
	Types, Construction, Principle of Operation, Characteristics, Drives / Control and Applications of – 1. Stepper / Stepping Motors 2. Servo Motors 3. Printed Circuit Board (PCB) Motors 4. Universal Motors	

Term Work:

The term work / assignments shall consist of record of topics from the list given below.

1. Laboratory demonstration of PMSM motor and drive.
2. Laboratory demonstration of BLDC Drive.
3. Experimental analysis of Reluctance Motor Drive.
4. Laboratory demonstration of Stepper Motor Drive.
5. Laboratory demonstration of Linear Induction Motor.
6. Laboratory demonstration of AC / DC Servo motor.
7. Laboratory demonstration of Induction Generator.

Text Books:

7. P. S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers
8. K. Venkatratnam, 'Special Electrical Machines', University Press
9. A. E. Fitzgerald, Charles Kingsley, Stephen Umans, 'Electric Machinery', Tata McGraw Hill Publication
10. V. V. Athani, 'Stepper Motors: Fundamentals, Applications and Design', New Age International
11. T. J. E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford Publication
12. Ion Boldea, 'Linear Electric Machines, Drives and Maglevs', CRC Press

Reference Books:

5. M. G. Say "Alternating current Machines", Pitman & Sons
6. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London
7. P. C. Sen, " Principles of Electrical Machines and Power Electronics", John Willey & Sons

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:

1. Solve the unsolved question from the books Unit wise.
2. Prepare report from NPTEL video lectures.
3. Solve the University Question Papers Unit wise.
4. Group Discussions from syllabus topics from students and prepare report on the same.
5. Industrial visit to electrical machine manufacturing company and prepare report on the same.
6. Market survey for various electrical special machines and preparing report on the same.

Elective II: Illumination Engineering

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 25 Marks Oral:25Marks	01Credit

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamentals of Electrical Engineering & Color acknowledgement.

Course Objectives:

1.	Basics of Illumination Engineering.
2.	Illumination Design
3.	Interior & Exterior Illumination

Course Outcomes:

1.	To study working of various light sources.
2.	To design illumination systems as per illumination laws.
3.	To make students perform interior lighting design
4	To make students perform Exterior lighting design
5	To study various lighting systems such as solar, cold lighting
6	To make students able to apply lighting design in green buildings.

UNIT 1	**Basic physics of Light**	**(06 Hours)**
	Nature And Properties Of Light. Radiation, color, eye & vision; different entities of illuminating systems; Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers;	
UNIT 2	**Illumination design**	**(06 Hours)**
	Luminaries, wiring, switching & control circuits; Laws of illumination; illumination from point, line and surface sources. Photometry and spectrophotometry; photocells. Environment and glare. General illumination design.	
UNIT 3	**Interior lighting**	**(06 Hours)**
	Industrial, residential, office departmental stores, indoor stadium, theater and hospitals. Lighting For *Hazardous Areas*	
UNIT 4	**Exterior lighting**	**(06 Hours)**
	Flood, street, aviation and transport lighting, lighting for displays and signaling- neon signs, LED-LCD displays beacons and lighting for surveillance. *Sports lighting.*	

UNIT 5	**Other lighting designs**	**(06 Hours)**
	1) Solar Lighting 2) Day-lighting for building 3) Cold Lighting 4) Energy efficient lighting.	
UNIT 6	**Lighting in sustainable buildings**	**(06 Hours)**
	1) Reduction methods of Lighting pollution 2) Significance of Lighting in Green building design. 3) Comparison of conventional and new energy saving lighting appliances. 4) LEED certification	

TermWork:
1. Study of commercial catalog for LEDs, CFLs and Tubes for understanding lumens output and wattages of each lamps.
2. Study of Design and assemble various Illuminating lamps.
3. Study of Design of illumination for Hotel.
4. Study of Design of illumination for residential sector
5. Study of Design of illumination for office departmental stores.
6. Study of Design of illumination for Hospital.
7. Study of Design of Solar Lighting for College.
8. Study of Design of Energy efficient lighting
Text Books:
National Lighting Code- Published by Govt of India
Reference Books:
1) Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition
2) IES Lighting Handbook – IES North America
3) Interior Lighting – Boer, Fischer, Pub – Philips Technical Library
4) Website: http://lighting.sustainablesources.com/

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Assignments:-

1. Define and explain Radiation, color, eye & vision
2. Discuss Different entities of illuminating systems
3. Write a short note on General illumination design
4. State and explain Laws of illumination
5. Design illumination for Industrial, residential, office departmental stores,
6. Design illumination for indoor stadium, theater and hospitals.
7. Design illumination for Flood, street, aviation and transport lighting
8. Design illumination for lighting for displays

9. Write in brief about Solar Lighting
10. What is Significance of Lighting in Green building design