NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Syllabus for

Third Year Electrical Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER – V and VI

W.E.F 2014 – 2015

PROGRAM EDUCATIONAL OBJECTIVES. (PEOs)

The Board of Studies in Electrical Engineering of North Maharashtra University, Jalgaon(India) has defined a set of program education objectives. The Program Educational Objectives of Electrical Engineering programs are designed to provide graduates with:

PEO1: Professional Knowledge: Graduates shall acquire the fundamental and advanced knowledge in Electrical Engineering subjects along with additional knowledge about other subjects like Mathematics, Basic Sciences, Inter-disciplinary Engineering, Management and Economics to solve basic and complex engineering problem. Graduates will be able to design system within realistic constraints for sustainable developments.

PEO2: Professional Employability: Graduates will have a successful career in Electrical Engineering. Graduates will succeed in getting the entry-level engineering positions in Generation, Transmission, Manufacturing, Government sectors at regional, national levels and an Entrepreneur.

PEO3: Higher Studies & Life Long Learning: Graduates may pursue their professional development through self learning, advanced degree and continue life-long learning. Graduates will be able to use software and modern engineering tools.

PEO4: Social Engineering: Graduates will aware of social responsibility, ethical values, safety standard, economical and environmental issues so that they serve the society better.

PROGRAM OUTCOMES (POs)

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. An ability to function on multidisciplinary teams.
e. An ability to identify, formulates, and solves engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i. Recognition of the need for, and an ability to engage in life-long learning.
j. Knowledge of contemporary issues.
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
l. An ability to work professionally in both software and hardware system areas including the design and realization of such systems.

North Maharashtra University, Jalgaon.

Syllabus Structure For Third Year Electrical Engineering w.e.f year 2014-15

Semester –V

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme				Total	Credits
							Theory		Practical			
			Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	ISE	ESE	ICA	ESE		
	Electrical Machines – II (TH)	D	3	--	--	3	20	80	--	--	100	3
	Power System – II (TH)	D	3	--	--	3	20	80	--	--	100	3
	Power Electronics (TH)	D	3	--	--	3	20	80	--	--	100	3
	Electromagnetic Engineering (TH)	D	3	--	--	3	20	80	--	--	100	3
	Industrial Organization & Management (TH)	C	3	--	--	3	20	80	--	--	100	3
	Electrical Machines –II (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Power System -II (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Power Electronics (LAB)	D	--	--	2	2	--	--	25	25 (OR)	50	1
	Electrical and Electronic Workshop (LAB)	D	--	--	2	2	--	--	25	--	25	1
	Software Application – I (LAB)	B	1	--	2	3	--	--	50	--	50	2
	Industrial Training/EDP/ Special Study	D	--	--	--	-	--	--	25	--	25	2
	Total		**16**	**--**	**10**	**26**	**100**	**400**	**175**	**75**	**750**	**23**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

North Maharashtra University, Jalgaon.

Syllabus Structure For Third Year Electrical Engineering w.e.f year 2014-15

Semester –VI

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme				Total	Credits
							Theory		Practical			
			Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	ISE	ESE	ICA	ESE		
	Control System – I (TH)	D	3	--	--	3	20	80	--	--	100	3
	Electrical Measurement – II (TH)	D	3	--	--	3	20	80	--	--	100	3
	Electrical Machine Design (TH)	D	3	--	--	3	20	80	--	--	100	3
	Microprocessor & Microcontroller (TH)	D	3	--	--	3	20	80	--	--	100	3
	Entrepreneurship Development (TH)	C	3	--	--	3	20	80	--	--	100	3
	Control System – I (LAB)	D	--	--	2	2	--	--	25	25 (OR)	50	1
	Electrical Measurement – II (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Microprocessor & Microcontroller (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Software Application – II (LAB)	B	--	--	2	2	--	--	25	--	25	1
	Minor Project	D	--	--	2	2	--	--	50	--	50	2
	Seminar-I	D	--	--	2	2	--	--	25	--	25	2
	Total		**15**	**--**	**12**	**27**	**100**	**400**	**175**	**75**	**750**	**23**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

Course Title	Short Title	Course Code
Electrical Machines – II	**EMC-II**	

Course Description:

This course is an advanced level Electrical Machines-I which will further strengthen the knowledge of the students. The course explores on understanding of construction, basic principles underlying the operation of electrical machines, performance, characteristic and testing of AC Machines, Voltage regulation of synchronous alternator, parallel operation and salient features and characteristic of synchronous motor. It also gives the platform to understand construction, working, performance and application of three phase and single phase motors.

Lectures	Hours/Week	No. of Weeks	Total Hours	Credits
	03	15	42	03

Prerequisite Course(s): Knowledge of Electrical Machine-I at second year Engineering.

General Objectives:

The object of syllabus to impart the fundamental knowledge of Synchronous machines. Students will able to develop their ability to apply the specific procedures for comprehensive treatment of rotating machines. In the earlier stage the machine worked in isolation and its simple analysis was sufficient. Now the electric machines form an integral part of large system comprising of other components as well. The object is not great depth, but presentation through enough to give theory at a level that can be understood by undergraduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of manufacturing, testing operation and control.

Course Outcomes:

After successful completion of this lab students will be able to:

1. Apply basic knowledge of science and engineering to understand electrical machines.
2. Understand construction, concepts, principles of operation, testing and application of synchronous machines, induction motor and special function motors.
3. Understand the behavior of synchronous machine on infinite bus and analyze data for qualitative and quantitative parameters to determine characteristics of machines by performing practical.
4. Perform professional duties in team of manufacturing, testing, operation and maintenance with the sense of safety precautions.
5. Apply knowledge for technological subjects such as utilization of electrical energy, switch gear and machine design for economical and sustainable developments.
6. Do higher studies and able to use updated software and tools for continuous updating of knowledge.

Electrical Machines – II

(Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

UNIT-I: Synchronous Alternator-I **09 Hours, 16 Marks**

Principle of generator, construction, excitation system, Arrangement of armature winding, E.M.F. equation , winding factors.

Alternator on- load , effect of armature current ; armature reaction ;resistance drop; Concept leakage reactance, synchronous reactance and synchronous impedance.

Voltage regulation of non salient pole alternator by direct load testing, synchronous impedance method; (e.g. method), m.m.f. method and potier triangle method

UNIT-II: Synchronous Alternator-II **09 Hours, 16 Marks**

Two reaction theory for salient pole machines, direct axis and quadrature axis reactance; their determination by slip test; Voltage regulation of salient pole alternator.

Power: power angle relation for non salient pole machines and salient pole

Parallel operation of alternator: need, conditions and method of parallel operation, Two alternators working in parallel, Effect of changing mechanical torque and excitation. Load sharing between two parallel connected alternators. Alternator on an infinite bus . induction generator

Unit-III: Synchronous Motors: **08 Hours, 16 Marks**

Motor action , phasor diagram on the basis of synchronous impedance, expression for gross mechanical power develop; power flow. Operation with constant load and variable excitation : locus of tip of current phasor under the above condition and v curve

Operation with const. excitation and variable load : locus of tip of current phasor circle phasor. Starting method, hunting and it causes and remedies.

Unit-IV: Poly Phase Induction Machines **08 Hours, 16 Marks**

Type and construction , working principal of induction motor, induction motor as generalized transformer, ,slip, rotor e.m.f. current, power, torque relations, torque slip characteristics, condition for maximum torque ,power stage in induction motor, losses and efficiency circle diagram and computation, Methods of starting of slip-ring and cage rotor induction motor ,varies types of starters, double squirrel cage motors, cogging, crawling of induction motor , Speed control of induction motor.

Unit-V : Single Phase Motor **08 Hours, 16 Marks**

Classification, production of magnetic field, equivalent circuit, production of toque, speed torque characteristic and application of capacitor start induction motor, split phase induction motor, shaded pole induction motor, AC series and universal motor. Comparison of single phase and three phase induction motor.

Special purpose machines:- single phase synchronous motor, repulsion motor, reluctance motor, hystresis motor, and linear induction motor.

Reference Books:

1. E.W.Clayton. "Design and Performance of D.C. Machines"
2. M.G.Say. "Design and Performance of A.C. Machines" CBS Publication
3. Langsdorf, " A.C.Machines," TMH.
4. Nagrath and Kothari "Electric Machine" –TMH
5. S K Bhaticharya, "Electrical Machines" –TMH
6. B. L. Theraja, "Electrical Technology", Vol – II, S. Chand Publucation
7. P. S Bimbhra, "Electrical Machinery" 2/E, Khanna Publishers
8. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co
9. V K Mehta and Rohit Mehta, ' Principles of Electrical Machines" S Chand Publication
10. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Power System – II	**PS-II**	

Course Description:

Power System-II explores the knowledge of parameter, characteristic and performances of transmission line. The subject emphasis on different faults calculation and concept of load flow analysis.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s): Knowledge of Power System-I at second year Engineering.

General Objectives:

The approach has always been to develop the thinking process of students in reaching a sound understanding of broad range of topic in power system area of electrical engineering. The object is to promote the students' interest in learning more about the electric power industry. The object is not great depth, but presentation through enough to give theory at a level that can be understood by under graduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of power system.

Course Outcomes:

After successful completion of this course students will be able to:

1. Apply basic knowledge of science and engineering to understand power system.
2. Describe the role of Power System Engineer and necessity of power system analysis to provide good quality, uninterruptable service to the consumer.
3. Represent synchronous machine, transmission line and power transformer to evaluate the performance of power system.
4. Evaluate reactance of synchronous machine on no load and loaded condition.
5. Analyze the power system in terms of symmetrical and unsymmetrical components to calculate the effect of symmetrical and unsymmetrical faults on power system.
6. Understand the concept of load flow analysis for continuous monitoring of power system by using modern computational techniques.
7. Do higher studies in the field of power system analysis and discharge the professional duties as Power System Engineer for economical development through modern technology.

Power System-II

(Course contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit I: Line parameters **09 Hours,16 Marks**

Introduction: Constituents of power system and role, necessity of power system analysis Real, reactive , complex power and its direction.

Line parameters: Inductance of three phase line with equilateral and unsymmetrical spacing, Bundled conductor, parallel circuit lines .

Capacitance of transmission line: capacitance of two wire, capacitance of equilateral and unsymmetrical spacing, effect of earth on the capacitance of three phase transmission line, bundled conductors, parallel circuit three phase line.

Unit II: Representation of power system component and characteristic of transmission line: **09 Hours,16 Marks**

Representation of power system: Single phase representation of balance three phase network, one line diagram, impedance diagram (reactance diagram), per unit system, representation of synchronous machine and power transformer.

characteristic and performance of Long transmission line:equivalent circuit of long line, Ferranti effect, power flow through transmission line method of voltage control, receiving end circle diagram.

Unit III: Symmetrical fault analysis **08 Hours,16 Marks**

Transient on transmission line, short circuit current and reactances of synchronous machine on no load and loaded condition, The bus impedance in fault calculations, algorithm for short circuit studies.

Synthesis of unsymmetrical phasors from their symmetrical components, operators, symmetrical components of unsymmetrical phasors, power in terms of symmetrical components.

Unit IV:- Unsymmetrical faults **08 Hours,16 Marks**

Single line to ground fault (LG) on an unloaded generator , line to line fault (LL)on an unloaded generator, double line to ground fault(LLG)on an unloaded generator, unsymmetrical fault on power systems, Single line to ground fault (LG)on a power system, line to line fault (LL)on a power system , double line to ground fault(LLG)on a power system Faults through impedance, analysis of unsymmetrical faults

Unit V:- Load flow analysis: **08 Hours,16 Marks**

Load flow analysis: Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Seidel and Newton-Raphson method, approximation to N-R method,

Traveling Waves: Introduction to surge Impedance loading and its derivation, Introduction to travelling wave on long transmission line

Reference Books:

1. Kothari & Nagrath, "Modern Power System Analysis" 4th edition Tata Mc. Graw Hill
2. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.
3. C.L. Wadhwa, "Electrical Power System", New Age International.
4. Stagg and El-Abiad, "Computer Methods in Power System Analysis" TMH.
5. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
6. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International
7. Chakraborthy, Soni, Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
8. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press,2007.
9. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Power Electronics	**PE**	

Course Description:

Technology has improved by lips and bounds making the power devices more closely to an ideal switch. Power electronics has already found an important place in modern technology and has revolutionized control of power and energy. As the voltage and current ratings and switching characteristics of power semiconductor devices keep improving, the range of applications continues to expand in areas such as lamp controls, power supplies to motion control, factory automation, transportation, energy storage, multimegawatt industrial drives, and electric power transmission and distribution. The greater efficiency and tighter control features of power electronics are becoming attractive for applications in motion control by replacing the earlier electro-mechanical and electronic systems. Applications in power transmission include high-voltage dc (HVDC) converter stations, flexible ac transmission system (FACTS), and static-var compensators. In power distribution these include dc-to-ac conversion, dynamic filters, frequency conversion, and Custom Power System. The syllabus of Power Electronic deals with constructional and operational characteristic of power semiconductor devices, ac to dc , dc to ac converters, choppers and ac to ac converters.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : Knowledge first year subject Elements of Electrical & Electronics Engineering and second year subject Analog and Digital Electronic .

General Objectives:

Power Electronics is the art of converting electrical energy from one form to another in an efficient, clean, compact, and robust manner for convenient utilization. The objectives of Power electronic is to create an awareness about the general nature of Power electronic devices, key features of the principal Power Electronic Devices, operational analysis of single phase uncontrolled half wave and full wave rectifiers supplying resistive, inductive, capacitive and back emf type loads. The objectives intended to understand the different configurations of inverters , coppers and cycloconverters.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Describe the role of Power Electronics as an enabling technology in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc.
2. Understand the behavior of semiconductor devices operated as power switches.
3. Learn the basic concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies.
4. Ability to analyze and design ac-to-dc circuits.
5. Ability to analyze and design dc-to-ac inverters.
6. Design power factor correction (PFC) circuits to draw sinusoidal currents at unity power factor.
7. Understand and design single-phase and three-phase thyristor converters.
8. Ability to design, set up, and test power electronic circuits in the laboratory
9. Learn the role of Power Electronics in utility-related applications which are becoming extremely important.

Power Electronics

(Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

UNIT-I: **Modern Power Semi-conducting Devices** **09 Hours, 16 Marks**

Thyristors: Introduction, Basic Structure, Operating Characteristics of SCR (Static Characteristics and Dynamic Characteristics during Turn-on and Turn-off), Thyristor Turn-on Methods, Thyristor Protection, $di\ /\ dt$, dv/dt Protection, Design of Snubber Circuits,

Introduction, Basic Structure, ON-OFF Control and Operational characteristics and Applications: DIAC, TRIAC, Gate turn-off thyristor (GTO), PUT, Light Activated thyristor (LASCR), MOS Controlled Thyristors (MCT)

UNIT-II: **Firing circuits, Commutation Techniques, Multi-Connections of SCRs**

09 Hours, 16 Marks

Introduction, Basic Structure, ON-OFF Control and Operational characteristics and Applications Insulated Gate Bipolar Transistor (IGBT), Metal- Oxide Field Effect Transistor (MOSFET), MOS Controlled Thyristors (MCT),

Gate Triggering Circuits/ Firing circuits: R, RC firing circuits(half wave and full wave firing circuits), Ramp and Pedestal triggering,

Commutation Techniques/ Turn-off methods: Forced and Natural, Classification of Forced Commutation- Class A, Class B, Class C, Class D, Class E, Class F

Multi-Connections of SCRs: Series, Parallel connection, String Efficiency

Unit-III: Full Wave controlled Rectifiers **08 Hours, 16 Marks**

Single phase Full Wave Bridge Rectifiers (B-2) connection: With Resistive and Inductive load (R-L load in rectifying and inverting mode), Single phase Full Wave Mid-point converters(Rectifiers) (M-2) connection: With Resistive and Inductive load (R-L load in rectifying and inverting mode), Single phase Symmetrical and Asymmetrical Semiconverters (Half Controlled Bridge Circuits): With Resistive and Inductive load, Three phase Full Wave Full-Controlled Bridge Rectifiers (B-6) connection: With Resistive and Inductive load, Effect of Source Impedance and Effect of Overlap angle (Single phase and Three phase Full Wave Full-Controlled Bridge Rectifiers)

UNIT-IV: **Inverters** **08 Hours, 16 Marks**

Inverters classification, Series inverter, Single Phase Parallel inverter, Single Phase Half Bridge and Full Bridge Voltage Source Inverters (With Resistive and Inductive load), Harmonic reduction, Three Phase Bridge Inverters (180-Degree and 120-Degree mode Voltage source inverters)

Dual Converters: Principle of Operation Ideal and Non-ideal, Dual Converters With and Without circulating current Schemes

Cycloconveters: Principle, Single Phase Cycloconveters

Unit-V: **Choppers** **08 Hours, 16 Marks**

Principle of Operation, Step Down, Step Up Chopper, Multi-Phase Choppers, AC Choppers, Chopper Configuration: Class A, Class B, Class C, Class D, Class E,

AC Regulators**:** Single Phase Half and Full wave with Resistive and Inductive load, Three Phase AC regulators

Speed Control of DC motors: Chopper fed Separately Excited DC motors and DC Series Motors

Reference Books:

1. M. Rashid, "Power Electronics", PHI Pub.
2. M.D. Singh and Khanchandani, "Power Electronics", TMH Pub.
3. M. Rammamurty, "An Introduction to Thyristors and its Applications", East-West Press
4. Mohan , Undeland and Riobbins, "Power Electronics", Wiley India Pvt. Ltd.
5. L Umanand, "Power Electronics Essentials & Applications", Wiley India Pvt. Ltd.
6. P S Bhimbra, "Power Electronic" Khanna Publishers
7. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Electromagnetic Engineering	**EME**	

Course Description:
Electromagnetic field theory is an important fundamental course with great academic relevance progress in this exciting theory has made possible the advent of many technologies, such as wireless communication, antennas and wave propagation, micro wave engineering, etc. Interference and electrical noise problems that affect industry can also be better understood and their solutions can be provided using field theory.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s): knowledge of H.S.C. and first year subject Elements of Electrical & Electronics Engineering.

General Objectives: Electromagnetic field theory is the subject of great research, academic and industrial importance and has a large number of applications**.** The objectives to understand basic concepts of static electric field and its associated quantities, Know the boundary condition particularly a boundary between conducting material and free space. The course also deals with significance of moving charges, force between two current carrying conductors, time varying field and radiation and antennas.

Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Apply basic concepts of scalars and vector quantities to evaluate the impact of electromagnetic fields.
2. Understand the basic concepts of static electric field and its associated quantity to evaluate the force between two point charges using Coulomb's Law.
3. Know the boundary condition, particularly a boundary between conducting material and free space.

a. Use Poisson's and Laplacian equations to calculate potential, capacitance and electric field.

4. Understand the magnetization principle and Biot-savart law and its importance.
5. Analysis how a time varying magnetic field induces an electric field and apply Maxwell's equation for analysis of static , dynamic field conditions.
6. Understand of different antennas, parameters, principle pattern multiplication

Electromagnetic Engineering

(Course contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit – I: **Electrostatics** **09 Hours, 16 Marks**

a. Coulomb's Law, Concept of electric field and field due to point charge.
b. Concept of volume charge density: electric field due to line charge, sheet of charge
c. Electric flux-density, Gauss's law and Divergence theorem
d. Energy expanded in moving a point charge in electric field, Concept of potential difference between two points and potential due to point charge
e. Potential-gradient and relationship between electric field and potential

Unit – II: **Dipoles, Conductors, Dielecrics And Capacitance** **09 Hours, 16 Marks**

b. Dipole and its electric field and dipole-moment, Energy-density in electrostatic field
c. Concept of current-density, Current continuity equation, properties of conductors
d. Boundary conditions between conductor and free-space, Boundary conditions between two perfect dielectrics
e. Capacitance between parallel plates, co-axial cable and spherical shells, Energy stored in capacitors
f. Poisson's and Laplace's equations to calculate potential, capacitance and electric field

Unit – III: **Magnetostatics** **08 Hours, 16 Marks**

a. Biot-savart law and its vectorial form
b. Ampere's circuital law and its applications to co-axial law
c. Curl operator, magnetic flux-density.
d. Scalar and Vector magnetic potential
e. Magnetic flux-density, Stoke's theorem
f. Lorentz's force equation, Energy stored in magnetic field

Unit – IV: **Time Varying Fields** **08 Hours, 16 Marks**

a. Maxwell's equations in integral and differential form in time-varying fields, free-space, phasor form
b. Uniform plane-wave, Wave motion in free-space, perfect conductor, skin-effect
c. Wave motion in perfect dielectric and lossy dielectric medium
d. Poynting theorem

e. Reflection of uniform plane wave by perfect dielectric (Normal and oblique incidence)
f. Reflection of uniform plane wave by perfect conductor (Normal and oblique incidence)

Unit – V: **Radiation and Antennas** **08 Hours, 16 Marks**

a. Antenna fundamentals: Radiation intensity, Directive gain and Directivity, Power gain and efficiency, Effective length, Effective aperture, Radiation resistance
b. Reciprocity between transmitting and receiving antennas
c. Vector retarted potential, Radiation pattern
d. Antenna Arrays: Broadside arrays, End-fire Array, Binomial Array, Tchebyscheff Array
e. Principle of pattern multiplication
f. Types of Antennas: Folded dipole, Yagi-Uda Antenna, Horn Antenna, Parabolic and Cassegain Antenna

Reference Books:

1. W.H. Hyat, "Engineering Electromagnenic", Tata Mc Graw Hill.
2. S. P. Seth, "Elements of Electromagnetic fields", Dhanpat Roy and Sons
3. R G Kaduskar, " Principles of Electromagnetics", Publication- Wiley
4. Gottapu Sasibhushana Rao, " Electromagnetic Field Theory and Transmission Lines", Publication- Wiley
5. Edward C. Jordan & K. G. Balmain, Electromagnetic Waves & Radiating Systems Second Edition, PHI
6. K.D. Prasad, Antenna and Wave Propagation, Satya Publication
7. http://nptel.iitm.ac.in

Course Title | Short Title | Course Code

Industrial Organization & Management | **IOM**

Course Description:

The course explores concepts of management and functioning of organizations. It introduces both theoretical concepts and empirical applications, focusing particularly on production industries. Management studies have influenced every aspect of business thinking and planning. Apart from this, it also influenced our day-today lives in the form of technological advancements. The syllabus explores the knowledge of principle of management, financial management, human resource management, operational management and marketing management.

	Hours per Week	No. of Weeks	Total Hours	Semester
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : knowledge basic science and Electronics Engineering .

General Objectives: This subject is designed to expose the students to fundamental concepts of management, its processes and behavioral dynamics in organizations. It will also look at recent developments in business in the context of economic theory. It also aims at making students understand concepts, philosophies, and processes of managing the marketing & financial operations of a firm.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand various aspects of management.
2. Understand the concepts of human resource management, marketing management, financial management, production and operation management.
3. Estimate the financial feasibility of business and identify the various sources of financing Understand different industrial laws in views of safety, pollutions and societal developments.
4. Discharge professional duties in field of manufacturing and operational management.
5. Function on multidisciplinary teams and able to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
6. Do higher study in various new disciplines in the area of management like entrepreneurs in view of economic objectives of country, such as industrial development, regional growth, employment generation and development.

Industrial Organization & Management

(Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

UNIT I: Principles of Management **09 Hours, 16 Marks**

a. Basic Concepts: Definition, Nature, Importance, Management: Art and Science & as a Profession, Management Vs Administration, Evolution of Management: Introduction to Scientific Management by Taylor, Administrative, Management by Fayol, Contribution of Peter Drucker, Levels & Functions of Management, Forms of Business Organization.

b. Approaches to Management: Decision Theory Approach, Contingency Approach, Systems Approach.

c. Organization: Formal & Informal, Line & Staff relationship, Centralization vs. Decentralization, Span of Management, Departmentation, MBO.

UNIT II:- Managerial Economics: **09 Hours, 16 Marks**

a. Introduction:Meaning & Scope of Economics, Basic Theories, Law of Demand & Supply, Elasticity of Demand & Supply.

b. Consumer Theories: Meaning of Utility & Law of Diminishing Utility.

c. Cost Concepts: Opportunity Costs, Sunk Costs, Marginal Cost, Total & Variable Costs, Fixed Costs, Contribution, Law of Diminishing Return.

UNIT III: Operational Management **08 Hours, 16 Marks**

a. Plant location and layout: Factor affecting plant location, different type of plant layout, CPM PERT, quality control manufacturing system, store and inventory control

b. Work study –techniques of work study method study, work measurement, different charts and diagrams used in method study.

UNIT IV: Human Resource Management **08 Hours, 16 Marks**

a. Human resource planning, Recruitment, Selection, Placement & Induction, Performance Appraisal & Development, Employee Training, Internal & External Mobility & Retention Management, Wage & Salary Administration, Fringe Benefits & Incentives Payments, Collective Bargaining, Performance appraisal , compensation

b. Industrial Laws: The factories Act 1947, The Workmen's Compensation Act 1923, Maternity Benefit Act The Payment of Wages Act 1936, The Apprentices Act 1961, industrial safety, prevention of accidents pollution control act

UNIT V: Marketing Management & Financial Management 08 Hours, 16 Marks

a. Introduction to Marketing: Concept of Market, Types of Market, Definition, Nature & Scope of Marketing, Marketing Approaches, Marketing Process, Functions of Marketing Management, 7 P's of Marketing. Advertising media of advertising market forecasting.

b. New trends in Marketing: Green Marketing, e- marketing & Viral Marketing.

c. Introduction to Financial Management: Meaning, Nature & Scope of Financial Management, Capital Structure, Types & Sources of Finance, Money Market & Capital Market, Role of Financial Institutions in Industry.

Reference Books:

1. O P Khanna, "Industrial Engineering Managements"
2. L.M.Prasad, "Principles of Management", Himalaya Publications Ltd
3. D.N. Dwivedi, "Managerial Economics", Vikas Publications
4. S.Chand by S.S.Khanka "Human resource Management"(Text & Cases),
5. P.Subba Rao "Essentials of HRM & IR" (Text, Cases & Games), Himalaya Publishing House
6. R.S.N. Pillai, Bhagavathi , "Legal Aspects of Business" (Mercantile Laws including Industrial & Company Laws)
7. Philip Kotler, "Marketing Management", Tata McGraw Hill
8. Ravi M. Kishor, "Financial Management", Taxmann Publication.

Course Title	Short Title	Course Code
Electrical Machines – II Lab	**EMC – II Lab**	

Course Description:

In this laboratory course emphasis on imparting the practical knowledge and understanding of basic principles, determination of characteristic , performance and testing of AC Machines, Voltage regulation of synchronous alternator. Application of single phase motors

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s): Knowledge of Electrical Machine-I at second year Engineering.

General Objectives:

The objective of the laboratory is to impart the fundamental knowledge of Synchronous machine and AC motors. Students will able to develop their ability to apply the specific procedures for analyze the experimental results. The students will able to understand the characteristic of Synchronous alternator and motor, application in process and manufacturing. Application of different methods to find voltage regulation of synchronous alternator. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices.

Course Outcomes:

After successful completion of this lab course students will be able to:

1. Apply basic knowledge of science and engineering to understand electrical machine
2. Understand construction, concepts, and principles of operation, testing of synchronous machines and special function motors.
3. Analyze data for qualitative and quantitative parameters to determine characteristics of machines by performing practical
4. Apply knowledge for technological subjects such as utilization of electrical energy, switch gear & protection, manufacturing processes and safety precautions.
5. Discharging duties in technical field for economical, societal and sustainable developments.
6. Do higher studies and able to use updated software and tools for continuous updating of knowledge.

Electrical Machines-II Lab

(Lab Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Determination of voltage regulation and efficiency of three phase alternator by direct load test.
2. Open and short circuit test on three phase alternator: determination of its regulation by e.m.f. method and m.m.f. method.
3. Zero power factor test on three phase alternator: determination of regulation by Potier trangle method.
4. Determination of direct axis and quadrature axis reactance by slip test on synchronous machine. Determination of voltage regulation by two reactance theory.
5. Synchronizing alternators: lamp methods and use of synchroscope.
6. Synchronous alternator on infinite bus: behavior of machine under change in mechanical power and excitation.
7. Characteristic of synchronous motor at constant load and variable excitation.
8. Characteristic of synchronous motor at constant excitation and variable load.
9. Determination of performance of three phase induction motor by direct load test.
10. Determination of performance of three phase induction motor by no load, blocked rotor test and construction of circle diagram.
11. No load and blocked rotor tests on capacitor start single phase induction motor and determination of parameters of equivalent circuit.
12. Load test on single phase induction motor.
13. Speed control of three phase Slip Ring Induction Motor.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work , performance and oral in the practical examination.

Course Title	Short Title	Course Code
Power System – II Lab	**PS – II Lab**	

Course Description:
Power System-II explores the knowledge of parameter, characteristic and performances of transmission line. The subject emphasis on different faults calculation and concept of load flow analysis.

Practical	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	**15**	**28**	**1**

Prerequisite Course(s): Knowledge of Power System-I at second year Engineering.

General Objectives: The approach has always been to develop the thinking process of students in reaching a sound understanding of broad range of topic in power system area of electrical engineering. The object is to promote the students' interest in learning more about the electric power industry. The object is not great depth, but presentation through enough to give theory at a level that can be understood by under graduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of power system.

Course Outcomes:
After successful completion of this lab students will be able to:

1. Apply basic knowledge of science and engineering to understand practical behavior of power system.
2. Describe the role of Power System Engineer and necessity of power system analysis to provide good quality, uninterruptable service to the consumer.
3. Evaluate the performance of long and medium transmission line using ABCD parameter, and effect of Var compensation on voltage profile.
4. Evaluate reactance of synchronous machine on no load and loaded condition.
5. Analyze the power system in terms of symmetrical and unsymmetrical components to calculate the effect of symmetrical and unsymmetrical faults on power system.
6. Understand the concept of load flow analysis for continuous monitoring of power system by using modern computing tools.
7. Do higher studies in the field of power system analysis and discharge the professional duties as Power System Engineer for economical development through modern technology.

Power System-II Lab

(Lab Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(PR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Measurement of ABCD parameters of a medium transmission line.
2. Measurement of ABCD parameters of a long transmission line.
3. Plotting of receiving end circle diagram to evaluate performance of medium transmission line.
4. Study of the effect of VAR compensation on the profile of receiving end voltage using capacitor bank.
5. Static measurement of sub-transient reactance of a salient-pole alternator.
6. Measurement of sequence reactance of a synchronous machine.
7. Determination of steady state power limit of a transmission line.
8. Unsymmetrical fault analysis for LL,LG, LLG FAULT ON A.C / D.C network analyzer
9. Formulation and calculation of Y- bus matrix of a system using software.
10. Solution of a load flow problem using Gauss-Seidal method using asoftware.
11. Solution of a load flow problem using Newton-Raphson method using software.
12. Unsymmetrical fault analysis of a 3-bus system using a software.
13. Calculation of inductance and capacitance for symmetrical and unsymmetrical configuration of transmission line using software.

Note: Lab file should consist of minimum **Eight** experiments out of eight experiments any two experiments using professional software such as MALAB, Matpower,PSIPCE etc.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work , performance and oral in the practical examination.

Course Title	Short Title	Course Code
Power Electronics Lab	**PE Lab**	

Course Description:

The greater efficiency and tighter control features of power electronics are becoming attractive for applications in motion control by replacing the earlier electro-mechanical and electronic systems. Applications in power transmission include high-voltage dc (HVDC) converter stations, flexible ac transmission system (FACTS), and static-var compensators. In power distribution these include dc-to-ac conversion, dynamic filters, frequency conversion, and Custom Power System.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s) : Knowledge first year subject Elements of Electrical & Electronics Engineering and second year subject Analog and Digital Electronic .

General Objectives:

Power Electronics is the art of converting electrical energy from one form to another in an efficient, clean, compact, and robust manner for convenient utilization. The objectives of Power electronic is to create an awareness about the general nature of Power electronic devices, key features of the principal Power Electronic Devices, operational analysis of single phase uncontrolled half wave and full wave rectifiers supplying resistive, inductive, capacitive and back emf type loads. The objectives intended to understand the different configurations of inverters , coppers and cycloconverters.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand the behavior of semiconductor devices operated as power switches.
2. Learn the basic concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies by conducting practical.
3. Ability to analyze the performance of ac-to-dc circuits and dc-to-ac inverters.
4. Understand and design single-phase and three-phase thyristor converters.
5. Ability to design, set up, and test power electronic circuits in the laboratory
6. Learn the role of Power Electronics in utility-related applications which are becoming extremely important.

Power Electronics - Lab

(Lab Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. Triggering Circuit of SCR
2. Characteristics of SCR,MOSFET,
3. Commutation circuit class C, class D
4. Single phase full wave controlled rectifiers R, R-L characteristics
5. Single phase semi-converter
6. Three phase full wave controlled rectifiers
7. Step up chopper
8. Step down chopper
9. Series and parallel inverter
10. Three phase inverter

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Course Title | Short Title | Course Code

Electrical and Electronic Workshop | **EEW Lab**

Course Description:

This course provides the basic practical knowledge about the electrical electronics engineering. The course includes the study of different electrical symbols, electrical shocks and safety precautions, equipments used for the measurement and testing of electrical and electronics devices, different types of electronic circuits, The course may includes visit to the electrical industries or power plant for the enhancement of practical knowledge.

	Hours per Week	No. of Weeks	Total Hours	Semester
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s) : knowledge of H.S.C. and first year subject Elements of Electrical & Electronics Engineering .

General Objectives:

The objective of the course is to provide knowledge about practical practices used in electrical engineering. This course will help students to use various tools for measurement and testing of electrical apparatus. The subject provides scope for practical applications of electrical engineering. The course will also help students to use and implement efficient and techno commercial aspect of maintenance and installation.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand various electrical symbols and their use in electrical electronics drawing.
2. Familiar with the safety precautions and practices while working in industrial and domestic premises.
3. Understand various maintenance schemes such as preventive, breakdown maintenance.
4. Select correct size and type of cables and wires for different applications.
5. Use different types of measuring instrument and instrumentation and testing equipments.
6. Select correct rating of fuse and MCB for protection scheme and safety.
7. Discharge the professional duties in technical field of maintenance and installation.

Electrical and Electronics Workshop

(Lab Course contents)

Semester: V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25Marks**

Practical: 2 Hrs/Week

Teacher should facilitate learning following lab experiments:

1. Details and Layout of DC Armature Windings.
2. Details and Layout of AC Armature Windings.
3. Study of substation equipment:
   a. Classification and use of Lightening arrester
   b. Different type of isolators.
   c. Substation earthing
4. Transformer
   a. Standard rating, vector group of power transformer.
   b. Standard rating of instrument transformer
   c. Class of accuracy for instrument transformer.
5. Study of Starters:
   a. Three phase induction motor starter.
   b. Study of three phase induction motor reverse forward starter.
6. Study of different contactor ,relay and timer with switching demonstration.
7. Study of automatic star delta and soft starter for three phase induction motor.
8. Study and Testing of:
   a. Diode
   b. BJT
   c. MOSFET
   d. IGBT
9. Study of Electronic ballast and fan regulator:
10. Fabrication of single phase capacitor filter rectifier circuit. Or fabrication of any small electronic circuit for domestic and commercial application.

Note: The term work should include a minimum **eight** experiments. Workshop practical practices should be based on above mentioned topics.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Reference Books:

1. A. K .Sawhney, Electric Machine Design Tenth Edition, Danpat Ray and Sons.
2. L Umanand, " Power Electrical Essential and Application", Willey Publication.
3. S L Uppal, "Electrical Wiring, Estimation and Costing"
4. Surjit Singh, "Electrical wiring, Estimation and Costing"
5. S K Bhattacharya, "Electrical wiring, Estimation and Costing"
6. B R Gupta, "Electrical Wiring, Estimation and Costing"

Course Title	Short Title	Course Code
Software Application-I	**SA-I**	

Course Description:
The objective of this course is to introduce the students to the fundamental concepts of MATLAB and enable them to apply these concepts for solving real world problems. This course includes the basic structure and statements required for simple mathematical problems in MATLAB. This course provides the basic concepts of plot and other useful tools required to solve the problems.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**1**	**15**	**14**	**2**
Practical	**2**	**15**	**28**	

Prerequisite Course(s): Knowledge of mathematics and subject computer programming at first year engineering.

General Objectives: The objective of the course is to provide students with the essential knowledge of C language and MATLAB programming. This course will help students to use various modern tools for solving the problems of electrical engineering. The subject provides scope for practical applications of electrical engineering. The course will help students to analyze the electrical systems using the software. The course provides the effective approach for the higher studies in the efficient system design.

Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Know use of the appropriate statements available in the C and C++ language and MATLAB.
2. Implement small and medium programs of varying complexity using the most commonly used features of the language.
3. Employ good programming style, standards and practices during program development.
4. Solve the different numerical techniques and perform Matrix operations.
5. Understand and use of MATLAB for solving simple mathematical problems.
6. Plot simple, 2-D and 3-D plots using MATLAB.
7. Use modern engineering tools in MATLAB which are useful for analyzing and designing of electrical power system.

Software Application-I

(Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme:

Lectures : 1 Hrs/Week

Unit-I Introduction to Matlab **03 Hours**

1. Standard Matlab windows
2. Operations with variables : naming ,checking existence, clearing and operations
3. Arrays : columns and rows: creation and indexing , size & length , multiplication, division, power and operations

Unit-II Writing script **02 Hours**

1. Writing script files : logical variables and operators , flow control and loop operators
2. Writing functions : input/output arguments , function visibility, path and Matlab startup.
3. Simple graphics : 2D plots and figures and subplots

Unit-III Data and data flow in Matlab **02 Hours**

1. Data types: Matrix, string, cell and structure, creating, accessing elements and manipulating of data of different types.
2. File Input-Output: Matlab files , text files , binary files , mixed text-binary files

Unit-IV Function minimization and parameters search. **02 Hours**

Polynomial fit : 1D and 2D fits , Data windowing , Error bounds

Unit-V Handle graphics and user interface **03 Hours**

Pre-defined dialogs: handle graphics : graphics objects , properties of objects and modifying properties of graphics objects

Reference Books:

1. Rudra Pratap, "Getting Started With Matlab: A Quick Introduction For Scientists And Engineers" Oxford University Press.
2. Dr. Shailendra Jain, "Modeling & Simulation using MATLAB-Simulink", Wiley India.
3. Yashavant Kanetkar, "Let Us C", BPB Publications, 10/E, 2010.
4. Stephen G Kochan "Programming in C", Pearson Education, 3/E, 2004.
5. Using MATLAB, Version 6, The Math Works, Inc., 2000.
6. MATLAB function reference, The Math Works, Inc., 2000.
7. Using MATLAB Graphics, Version 6, The Math Works, Inc., 2000.
8. MATLAB Release Notes for Release 12, The Math Works, Inc., 2000.

Software Application-I
(Lab Course Contents)

Semester-V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 50 Marks**

Practical : 2 Hrs/Week

Teacher should facilitate learning following lab experiments:

1. A. Simple Arithmetic Calculation: Perform simple arithmetic calculations: Addition, subtraction, multiplication, division and exponentiation.
   B. Assign values to variables.
   C. Suppress screen output.
   D. Control the appearance of floating point numbers on the screen.
2. A. Compute the Y-Coordinates of line with given slope m and the intercept c at the x coordinates.
   B. Create a vector t with 10 elements: 1, 2, 3,……., 10 and compute the following quantities: X= t sin(t), Y=(t-1)/(t+1), Z=$\sin(t^2)/ t^2$
   C. Create Matrices, Vectors for finding the size of matrices and perform the addition, subtraction, multiplication, transpose and inverse operation.
3. Create : Simple sine plot, line plot, an exponentially decaying sine plot, space curve, log scale plot, Overlay plot and Fancy plots.
4. Create Polynomial curve fit and compare different fits.
5. A. Create a line along with an explicit handle and then use set command to change the line style, its thickness, and values of some y-coordinates.
   B. Write some text at a specified position, create its handle, and then use the set command to change the font size, font, and string of the text.
6. Study of different types of errors.
7. Write program to find voltage and power in voltage divider circuit.
8. Write a program to calculate voltage across any resistance in a circuit.
9. Write a program to find transient response in RC circuit.
10. Write a program to find transient response in RL circuit.
11. Write a program to plot voltage and current in resistive circuit.
12. Write a program to plot voltage and current in inductive and capacitive circuit.

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and assignment submitted by the student in the form of journal.

Course Title | Short Title | Course Code

Industrial Training/EDP/Special Study IT/EDP/SS

Course Description:

Industrial training and special study is very essential for understanding the latest advancement in electrical engineering. It makes bridge between theoretical knowledge and its implementation. The industrial training provides platform to understand general organization and its functions.

	Semester Credits
Two week Industrial Training/One week EDP/ Special Study	**2**

Course Objectives:

The objective of industrial training is to prepare students to work on multidisciplinary team. Student will be able to understand the use of modern tools and technique for testing and maintenance in electrical utilities.

Course outcomes:

Upon successful completion of industrial training/special study students will be able to:

1. Understand basic organizational structure of industry.
2. Work on multidisciplinary teams and understand the impact of engineering solutions in a global, economic, environmental, and societal context.
3. To analyze the different types of Case studies and Estimate the financial feasibility of project.
4. To develop Innovative ideas and implement the theoretical concepts in practical fields.
5. Use latest testing and measuring instrument and safety precaution at work place.
6. Communicate effectively and able to write detailed project report.

Industrial Training/EDP/Special Study

(Course Content)

Semester: V **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25Marks**

Industrial Training

- Student shall undergo industrial training for a minimum period of **two weeks** during summer vacations between fourth semester and fifth semester.
- The industry in which industrial training is taken should be a medium or large scale industry
- The paper bound report on training must be submitted by the student in the beginning of Fifth semester along with a certificate from the company where the student took training.
- Every student should write the report separately.
- Institute / Department/T&P Cell have to assist the students for finding Industries for the training.
- Students must take prior permission from Department before joining for Industrial Training.

OR

EDP (Entrepreneurship Development Program)

- Student has to participate in Entrepreneurship Development Program for a minimum period of **One week** during summer vacations between fourth semester and fifth semester.
- Every student must submit the paper bound report based on the program in the beginning of Fifth semester along with a certificate (Course / Program completion) from the program organizers.
- Every student should write the report separately.
- Institute / Department may arrange Entrepreneurship Development Program at their campus.
- Students must take prior permission from Department before attending any Entrepreneurship Development Program.

OR

Special Study

- Student has to submit name of three topics of his interest to the department.
- Special study in a group shall not be allowed.
- The three-member committee appointed by Head of Department shall allot one topic out of the three topics submitted by the student.
- Every student must submit the paper bound report based on special study at the end of Firth semester.
- Department should allot guide to all such students, for monitoring their progress

and guide them for literature survey / report writing etc.

- Evaluation of special study shall be done based on presentation made by student, followed by brief question answer session.

Evaluation of Industrial Training / EDP / Special Study

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training / EDP / Special study and based on knowledge / skill acquired by the student. The three-member committee appointed by Head of Department shall assess the reports and award marks based on following:

(a) Report	10 marks.
(b) Presentation	10 marks.
(c) Viva-voce at the time of presentation	05 marks.
Total:	**25 marks.**

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Syllabus for

Third Year Electrical Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER –VI

W.E.F 2014 – 2015

Course Title	Short Title	Course Code
Control System-I	**CS-I**	

Course Description:

The study of Control System Engineering is essential for the students of Electrical, Electronics, Mechanical, Aerospace & Chemical Engineering. It has applications ranges from Electrical Power System to process Control System. The course explores the knowledge of basic control systems, control system components, mathematical modeling, time response & frequency response analysis. The course also deals in concept of design & its preliminary consideration.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s): Mathematics and electrical engineering subject

General Objectives:

Control system engineering is an exciting field in which to apply engineering talents. The object of course to derive mathematical modeling , transfer –functions, time response and frequency response. The objectives are to find transient response and steady state error in given system.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Apply basic mathematical for modeling of control system and responses of first and second order system.
2. Describe the role of control system as an enabling technology in various applications such as in power systems, automation, renewable energy, etc.
3. Understand the response of control system subjected to different input signals, design, set up, and test control system in the laboratory.
4. Analyze and design open and closed control system.
5. Design dc servo motor and stepper motor to meet the characteristics of control system application.
6. Become proficient with computer skills (e.g., PSPICE and MATLAB) for the simulated analysis and design of control system and able to use control system in utility-related applications .

Control System -I

(Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit –I **09 Hours, 16 Marks**

The Control System:

Open loop & closed control; servomechanism, Physical examples. Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit –II **09 Hours, 16 Marks**

Time Response analysis:

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants. Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices

Unit –III **08 Hours, 16 Marks**

Control System Components:

Constructional and working concept of ac servomotor, synchros and stepper motor. Stability and Algebraic Criteria concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations. Root Locus Technique: The root locus concepts, construction of root loci

Unit –IV **08 Hours, 16 Marks**

Frequency response Analysis:

Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots

Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles.

Unit –V **08 Hours, 16 Marks**

Introduction to Design:

The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain. Review of state variable technique: Review of state variable technique, conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing.

Reference Books:

1. Nagrath & Gopal, “Control System Engineering”, 4th Edition, New age International.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, “Automatic Control System” Wiley India Ltd, 2008.
4. Norman s Nise, “Control System Engineering” Wiley India Pvt Ltd
5. Dr. Rajeev Gupta, “NISE’s Control System Engineering” Wiley India Pvt Ltd
6. D.Roy Choudhary, “Modern Control Engineering”, Prentice Hall of India.
7. Ajit K Mandal, “Introduction to Control Engineering” New Age International,2006.
8. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, “ Design of Feedback Control Systems”.
9. Narendra Singh Beniwal and Beniwal,”Automatic control system with Matlab Programming “University Science Press.
10. Eugene Xavier S.P. and Joseph Cyril Babu,J.,”Principles of control systems “S.Chand
11. S.Sivangaraju,L.Devi ,”Control Systems Engineering “New Age International Publishers.
12. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Electrical Measurement-II	**EM-II**	

Course Description:

This course provides a brief introduction to transducers and its response. This course also explores the knowledge of measurement of pressure, temperature and displacement by transducers. Construction, principle of working, characteristics, error and adjustment of different types measuring instruments.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : Knowledge of second year subject Electrical Measurement-I.

General Objectives:

To expose the students to a broad knowledge of experimental methods and measurement techniques. To train the students in the skill of operation of instruments in the electrical & electronic engineering applications. To understand the basic working of instruments. To understand the errors in measurements and their rectification. To gain proficiency in the use of common measuring instruments. To compare theoretical predictions with experimental results and to resolve any apparent differences.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand the basic concepts in measurement and measuring instruments.
2. Understand the need and process of standardization, calibration of instruments, their significance in process and manufacturing industries for international acceptance.
3. Select instruments on basis of accuracy, sensitivity and response time in generation, transmission, manufacturing, power system, testing and energy auditing purposes.
4. Perform technical and professional duties in any type of industries.
5. Do higher studies and use of modern instruments for automation, process control for sustainable developments.

Electrical Measurement-II

(Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures: 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

End Semester Exam duration: 03 Hours

Unit-I: **09 Hours, 16 Marks**

Introduction to instrumentation:

Definition, purpose, measurement – definitions, types and Classification of instruments, generalized measurement system, standards, and calibrations

Instrument Response :Instrument Response to step, ramp, sinusoidal i/p up to second order system. Errors – types – gross, systematic, random, limiting, sources of errors, techniques to minimize them.

Unit-II: **09 Hours, 16 Marks**

Introduction to transducers:

Definition, classification, selection of transducer**.** Measurement of temperature**:** using R T D, thermocouple, bimetallic, thermocouple. Pressure thermometers, pyrometers**.** Pressure Measurement: Bourdon Tubes, bellows, diaphragms. Vacuum Measurement**:** McLeod gauge, pirani gauge.

Unit-III: **08 Hours, 16 Marks**

Flow measurement-:

Rota meter, electromagnetic flow meter, hot wire anemometer, ultrasonic flow meter.

Displacement measurement : LVDT, strain gauge, -types, working principles, measurement circuitry Level measurement :mechanical, pneumatic methods , electrical methods- capacitance level gauge, hot wire / carbon resistance method nucleonic level gauge, ultrasonic method.

Unit-IV: **08 Hours, 16 Marks**

A .C. Bridges:

Classification, Maxwell, Anderson, hay, Schering, Campbell, and Wein Bridge , Special measuring instruments- construction and principles of 1 Ø & 3 Ø p.f.meters ,frequency meters ,synchronoscope, trivector meter , max. Demand Indicators, C.R.O.

Unit-V: **08 Hours, 16 Marks**

Recorders:

Necessity, construction, working, types- strip chart, circular chart, self balance potentiometric, X-Y recorder, ultraviolet recorder. Electronic technique : for measurement of voltage, current, power, energy, phase angle and rms values.

Reference Books:

1. E. W. Golding. , "Electrical Measurements and Measuring instruments", Reem Publication.
2. C. T. Baldwin. , "Fundamentals of Electrical Measurements", Kalyani Publication
3. Cooper and Derfllick, "Electronic Instrumentation and Measurements Techniques", 3rd edition, Prentice-Hall of India.
4. A. K. Sawney. "Electrical & Electronic Measurement and Instrumentation" Danpant Rai & Co.
5. J.B. Gupta, "Electrical & Electronic Measurement and Instrumentation", S K Kataria & Son.
6. R K Rajput, "Electrical & Electronic Measurement and Instrumentation", S Chand.
7. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Electrical Machine Design	**EMD**	

Course Description:
The course consists of general factor of machine design, material classification, temperature rise and rating of machines. It explores the design concept of transformer core, winding overall dimension performance and cooling design of transformer. The course also provides sound understanding and basic concepts of rotating machine design.

	Hours per Week	No. of Weeks	Total Hours	Semester Credit
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : Knowledge of Electrical Machines-I and Electrical Machines-II
General Objectives: The approach has always been to develop the thinking process of students in reaching a sound understanding of broad range of topic in electrical machine design. The object is to promote the students' interest in learning more about latest trend in electrical machine design. The object is not great depth, but presentation through enough to give theory at a level that can be understood by undergraduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of design and manufacturing industries.

Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering for design of electrical machines.
2. Understand the electrical engineering material characteristic for designing an energy efficient electrical machine.
3. Understand the temperature rise in electrical machines and impact on rating and duty of machines.
4. Ability to design an electrical machines and components to meet desired needs within realistic constraints such as economic, environmental, social, safety, manufacturability, and sustainability.
5. Function on multidisciplinary teams with professional and ethical responsibility.
6. Discharge duties in the field of design and manufacturing industries and able to do higher studies in optimal design and use latest software and engineering tools.

Electrical Machine Design
(Course Contents)

Semester-VI **Examination Scheme:**
Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**
Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**
(ESE) End Semester Exam duration: 03 Hours

Unit-I **09 Hours, 16 Marks**

Introduction- principles of design and design factors, rating, specifications, standards, brief study of magnetic, electric, insulating and other material. Theory of solid body heating, heating and cooling time curve, rating of machines, and type of duty.
Design of Starters-Shunt Motors, Series Motor, Slip ring induction motor.

Unit – II: **09 Hours, 16 Marks**

Design of Transformer- Design of distribution and power Transformer,-types, classifications, specifications, core construction, transformer winding, design of transformer, output equation of single phase and three phase transformer ,overall dimension, design of core, winding, estimation of leakage reactance for H.V. and L.V. winding, resistance of winding, calculation of losses, determination of voltage regulation.

Unit III: **08 Hours, 16 Marks**

Design Performances of Transformer-

No Load Current of –single phase, Three phase, Magnetizing Volt-ampere, change of parameters with change of frequency, Temperature rise of transformers , transformer oil as a cooling medium, temperature rise in plain walled tanks, design of tank with tubes ,air blast cooling, forced oil circulation , thermal rating , heating time constant of transformers.

Unit –IV: **08 Hours, 16 Marks**

Induction motors:

Relation between rating and dimensions of rotating Machines-symbols, Main dimensions , total loading, specific loading , output equation , factor affecting size of rotating machines , choice of specific magnetic loading , choice of specific electric loading , variation of output & losses with Linear dimensions , separation of D and L- d.c. Machines, Induction Motors , Synchronous Machines, standard Frames.
Design of three phase Induction Motors-design output equation, choice of average flux density in air gap, choice of ampere conductors per metre, efficiency & power factor, main dimensions.

Unit –V: **08 Hours, 16 Marks**

D.C.Machine Windings- types of D.C. Windings, choice and design of simplex and duplex lap and wave Windings, equalizer connections, dummy coils, concept of multiplex Windings, reason for choosing them.

A.C. Machine Windings- single and double layer, single phase ac Windings with integral and fraction slots, three phase Windings.

Reference Books:

1. A. K .Sawhney, Electric Machine Design Tenth Edition, Danpat ray and sons.
2. A. E .Clayton, Performance and Design Of DC Machine, Third Edition, ELBS, ISAAC Pitman Sons.
3. A. E. Clayton Performance and Design Of AC Machine, Third Edition, ELBS, ISAAC Pitman Sons.
4. N. Vinogradov, Electric Machine Winder, MIR Publication.
5. Say and Taylor, D.C. Electric Machine, ELBS, Pitman Sons.
6. Feinberg,Macmillan,Modern Power Transformer Design Practices.First Edition, Feinberg, Macmillan,
7. Transformers BHEL.
8. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Microprocessor and Microcontroller	**MPMC**	

Course Description:
The course explores knowledge of microprocessor and microcontroller. The course comprises of architecture, assemble language programming and interfacing of peripherals and their applications.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : Analog and digital electronic and software application at second year engineering.

General Objectives:
To meet the challenges of growing technology , student will be conversant with the programmable aspect of microprocessor and microcontroller. Programming is a process of problem solving and communication in language of mnemonics. The object of course is to understand microprocessor and microcontroller demand, concept and develop skill in two discipline hardware and programming.

Course Outcomes:
Upon successful completion of this course the students will be able to:
1. Apply basic electronic subject and software algorithm application for understanding architectures assemble language of microcontroller and microprocessor.
2. Know the pin configuration and memory organization of a typical microprocessor and microcontroller.
3. Develop assemble language programming and interfacing peripherals for wide application in electrical engineering.
4. Develop assembly language source code for applications that use I/O ports, timer and single/multiple interrupts
5. Apply techniques for measurement of electrical quantities by microprocessor.
6. Apply the knowledge of microprocessor and microcontroller in application of microprocessor and microcontroller based electrical protection system.
7. Do higher study in the field of automation, operation and control of power system by microprocessor and microcontroller.

Microprocessor and Microcontroller

(Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures : 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit – I: **09 Hours, 16 Marks**

8085 Microprocessor: Organization, architecture, Generation of control signal, Addressing modes, Instruction format classification of instructions, Instruction set, interrupt.- interrupt structure . Serial data transfer program using RIM and SIM

Unit-II **09 Hours, 16 Marks**

Programming Memory Interfacing: Introduction to assembly language programming , stack , subroutine, types of subroutine , I/O Mapped I/O and memory mapped I/O, Memory module chip capacity, address space,. Memory specification, Types of memory-ROM, RAM: static & dynamic, PROM, EPROM, EEPR0OM, memory organization & interfacing of RAM and ROM.

Unit-III **08Hours, 16 Marks**

Interfacing Peripherals and Applications: Study of common peripheral devices, their architecture ,control words and control register & different modes of operation 8155: static RAM, I/O ports, timers, 8255 PPI, 8279 keyboard display interface.

Unit-IV **08 Hours, 16 Marks**

Data Conversion and Applications :D to A – types, Ladder, R-2R , A to D converters, SAR type, dual slope. ADC 0808 architecture, interfacing with 8085 microprocessor.

Microprocessor Applications: Frequency measurement, phase angle and power factor measurement , current voltage measurement, KVA , KW and Maximum demand measurement**.**

Unit-V **08 Hours, 16 Marks**

Microcontroller:

8051microcontroller:architecure:, registers, SFRs pins, memory organization, I/O port structure, interrupts, timer and counter circuit, serial port.

8051Instruction set classification, addressing mode, simple assembly language programs. Programming related to Timer/Counter

Reference:

1. R.S. Gaonkar .”Microproccer Architecture, Programming, & Applications with 8085”, Third edition, Penram International Publication (India) Pvt. Ltd.
2. Leventhal, “8085 Assembly Languages Programming” Tata McGraw Hill.
3. B. Ram ,”Fundamentals of Microprocessors & Microcontrollers” Dhanpat Rai Publication.
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi andRolin D. McKinlay, “The 8051 Microcontroller and Embedded SystemsUsing Assembly and C”, Second Edition.
5. Kenneth J.Ayala “The 8051 Micro Controller :Architecture, Programming,”, Penram International, Mumbai.
6. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Entrepreneurship Development	**ED**	

Course Description: Last few decades have seen the advent of various new disciplines in the area of management. One such discipline, Entrepreneurship has emerged quite recently. The syllabus explore the concept of entrepreneurship, financial requirements of a new enterprise, Expansion strategies of an enterprise, challenges for small enterprises and Institutional Support for small enterprises

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**3**	**15**	**42**	**3**

Prerequisite Course(s) : knowledge of subject Industrial Organization And Management.

General Objectives:

The economic objectives of country, such as industrial development, regional growth, employment generation and development of small scale industries entirely depend on the growth of entrepreneurship. As concept, Entrepreneurship poses a challenge for entrepreneurs to select and implement business strategies to tread the glorious path of success and growth. Successful entrepreneurship requires passion of an entrepreneur and thus, it is more than the money and luck. In the contemporary world, the study of this discipline become of umpteen importance to understand the complexities of business environment at national and international levels.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand the various new disciplines in the area of management.
2. Understand concept of entrepreneurship and learn the procedure of setting up an enterprise.
3. Understand the concepts of human resource management, marketing management, financial management, production and operation management in a new enterprise.
4. Function on multidisciplinary teams and understand the impact of engineering solutions in a global, economic, environmental, and societal context.
5. Estimate the financial feasibility of business and identify the various sources of financing.
6. Understand the role of small scale enterprises in economic development of a country and understand the linkage between small and large scale enterprises.
7. Develop skills to become an entrepreneurs in view of economic objectives of country, such as industrial development, regional growth, employment generation and development of small scale industries through technological developments.

Entrepreneurship Development

(Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ESE) End Semester Examination: 80 Marks**

Lectures: 3 Hrs/Week **(ISE) Internal Sessional Examination: 20 Marks**

(ESE) End Semester Exam duration: 03 Hours

Unit I **09 Hours, 16 Marks**

Introduction to Entrepreneurship

Introduction, Concept of entrepreneurship: Significance of entrepreneurship, Theories of entrepreneurship, Models of entrepreneurship development

Definition of entrepreneur: Traits and characteristics of successful entrepreneur , Functions of an entrepreneur , Types of entrepreneurs, Factors influencing entrepreneur, Professional vs. family entrepreneurs, Entrepreneurial leaders vs. managers,

Entrepreneurial process: Entrepreneurial motivation, Entrepreneurial barriers, Women as entrepreneur , Role of woman entrepreneurs in society, Barriers to women entrepreneurs , Myths of entrepreneurship, Problems faced by entrepreneurs and capacity building for entrepreneurship, Profiles of successful entrepreneurs.

Unit –II **09 Hours, 16 Marks**

Financial requirements of a new Enterprise: Estimating financial requirements, Estimation of fix capital requirements, Estimation of working capital requirements

Identifying the sources of finance –sources of long-term financing: Sources of medium-term financing , Sources of short-term financing

Institutions providing financial assistance: Venture capital funding- venture capital funding in the Indian scenario, Venture capital funding process, Importance of financial management, Working capital management, Accounting and book keeping, Financial statement, Financial ration analysis

Unit –III **08 Hours, 16 Marks**

Expansion strategies of an Enterprise

Expanding and enterprise: Expansion through concentration, Expansion through integration, Expansion through diversification , Expansion through cooperation, Expansion through internationalization, Expansion through digitalization , Organization life cycle, Strategic management, The essence of business ethics

Unit –IV **08 Hours, 16 Marks**

Challenges for small Enterprises

Problem faced by small enterprises: Managerial problems, Marketing management, Human resource, Production management, Technological problems

Role of central and state governments in promoting small enterprises: Fiscal and tax concessions for small enterprises, Industrial policies for small enterprises, Importance of marketing, Customer relationship management (CRM), Marketing services

Unit- V **08 Hours, 16 Marks**

Institutional Support for small enterprises and decision support system

Institutions supporting small scale enterprises: Small scale industries (SSI) board, Khadi and village industries commission (KVIC), Micro, small and medium enterprises development organization (MSME-DO), National small industries corporation limited (NSIC), National institute for entrepreneurship and small business development (NIESBUD)' Indian institute of entrepreneurship (IIE), State industrial development / Investment Corporation (SIDCs/SIICs), State directorate of Industries (SDIs), District industry centers (DICs) ,Industry associations , Non-Governmental organization

Institutions providing financial association: Small industries development bank of India (SIDBI), State financial corporation (SFCs)

Technological up gradation and moderation of small enterprises: ISO 9000/14001 certification fee reimbursement scheme,

Reference Books:

1. Alpana Trehan, "Entrepreneurship" Published –Dreamtech Press.
2. Jack M. Kaplan, "Patterns of Entrepreneurship" Published -WILEY.
3. Poornima M. Charantimath, "Entrepreneurship Development –Small Business Enterprises" Publisher –Pearson.
4. Thomas W. Zimmerer & Norman M. Scarborough, "Essential Of Entrepreneurship and Small Business Management" 4th Edition , Publisher –Pearson.

Course Title	Short Title	Course Code
Control System-I Lab	**CS-I**	

Course Description:

The study of Control System Engineering is essential for the students of Electrical, Electronics, Mechanical, Aerospace & Chemical Engineering. It has applications ranges from Electrical Power System to process Control System. The course explores the knowledge of basic control systems, control system components, mathematical modeling, time response & frequency response analysis. The course also deals in concept of design & its preliminary consideration.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s): Mathematics and subjects of electrical engineering

General Objectives: Control system engineering is an exciting field in which to apply engineering talents. The object of practical to derive mathematical modeling, transfer – functions, time response and frequency response. The objectives are to find transient response and steady state error in given system.

Course Outcomes:

Upon successful completion of this practical course the students will be able to:

1. Apply basic of mathematical modeling of control system and responses of first and second order system.
2. Describe the role of Control system as an enabling technology in various applications such as in power systems, energy conservation, renewable energy, transportation etc.
3. Understand the response of control system subjected to different input signals, design, set up, and test control system in the laboratory.
4. Analyze and design open and closed control system.
5. Design dc servo motor and stepper motor to meet the characteristics of control system application.
6. Become proficient with computer skills (e.g., PSPICE and MATLAB) for the simulated analysis and design of control system and able to use control system in utility-related applications.

Control System-I Lab

(Lab contents)

Semester-V I **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week **(ESE) End Semester Examination(OR): 25 Marks**

Teacher should facilitate learning following lab experiments:

1. To determine speed-torque characteristics of an ac servomotor.
2. To study potentiometer as an error detector.
3. To study DC position control system
4. To determine time response of second order control system
5. To determine speed-torque characteristics of dc servomotor.
6. To study PID Controller.
7. To study synchro-transmitter and receiver and obtain output V/S input characteristics.
8. To Study Stepper Motor.
9. To determine time domain response of a second order system for step input and obtain performance parameters by using software .
10. To convert transfer function of a system into state space form and vice-versa, by using software .
11. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' for stability by using software.
12. To plot a Bode diagram of an open loop transfer function by using software.
13. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system by using software

Note: The minimum eight experiments are to be performed from the following list of experiments. Any Six experiments compulsorily to be performed from no 1 to 8 and any two from 09 to 15.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked questions on practical. Evaluation will be based answers given by student in oral examination.

Course Title	Short Title	Course Code
Electrical Measurement– II Lab	**EM- II Lab**	

Course Description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic, performance of different measuring instruments and measurement of different electrical quantities. It also gives the platform to understand need and importance of calibration and standardization.

Practical	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	**15**	**28**	**1**

Prerequisite Course(s): Knowledge of Electrical Measurement-I

General Objectives:

The objective of the laboratory is to impart the fundamental knowledge of measuring instruments. Students develop their ability to select the specific instrument in reference of ranges and resolution of instruments for proper and correct analysis. The students will able to understand the characteristic of measuring instruments. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices.

Course Outcomes:

Upon successful completion of this lab students will be able to:

1. Conduct practical and able to analyze the practical data for various purposes.
2. Measure various electrical quantities and circuit parameters
3. Able to select the measuring instrument with proper range and type for practical uses.
4. Calibrate various types of instruments as per IS .
5. Do professional duties in technical field and able to use advance measuring instruments.

Electrical Measurement-II LAB

(Lab Course Contents)

Semester: VI **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25Marks**

Practical: 2 Hrs/Week **(ESE) End Semester Examination Practical (PR) : 25Marks**

Teacher should facilitate learning following lab experiments:

1. Strain Measurement using strain gauge .
2. Study of CRO of it's different types and Applications.
3. Measurement of temperature by RTD/Thermocouple.
4. Study of pressure transducers.
5. Study of recorders.
6. Study of LVDT.
7. Measurement of inductance by Andersons Bridge.
8. Measurement of capacitance and loss angle of capacitor by Schering bridge.
9. Step response of meters.
10. Measurement of systematic errors of wattmeter.

Note: The term work should include a minimum **eight** experiments from the above list

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work , performance and oral in the practical examination.

Course Title | Short Title | Course Code

Microprocessor and Microcontroller Lab | **MPMC- Lab**

Course Description:

The practical course explores knowledge of microprocessor and microcontroller. The course comprises of architecture, assemble language programming and interfacing of peripherals and their applications.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s) : Analog and digital electronic and software application at second year engineering.

General Objective:

To meet the challenges of growing technology, student will be conversant with the programmable aspect of microprocessor and microcontroller. Programming is a process of problem solving and communication in language of mnemonics. The object of practical course is to understand microprocessor and microcontroller demand, concept and develop skill in two discipline hardware and programming.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Know the pin configuration and memory organization of a typical microprocessor and microcontroller.
2. Develop assemble language programming and interfacing peripherals for wide application in electrical engineering.
3. Develop assembly language source code for applications that use I/O ports, timer and single/multiple interrupts
4. Apply techniques for measurement of electrical quantities by microprocessor.
5. Apply the knowledge of microprocessor and microcontroller in application of microprocessor and microcontroller based electrical protection system.
6. Do higher study in the field of automation, operation and control of power system by microprocessor and microcontroller.

Microprocessor and Microcontroller LAB

(Lab Course Contents)

Semester: VI **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25Marks**

Practical: 2 Hrs/Week **(ESE) End Semester Examination Practical (PR) : 25Marks**

Teacher should facilitate learning following lab experiments:

1. Study of architecture and instructions of 8085 along with opcodes.
2. Study of architecture and instructions of 8051..
3. 8255 interfacing
4. Memory interfacing
5. Microprocessor 8085 assembly language programs based on data transfer instruction
6. Microprocessor 8085 assembly language programs based on arithmetic instruction
7. Microprocessor 8085 assembly language programs based on logical instruction
8. Applications of microprocessor 8085 in measurement of electrical quantity.
9. Applications of microprocessor 8085 in Electrical drives and speed control for stepper motor.
10. Microcontroller 8051 assembly language programs based on data transfer instruction.
11. Microcontroller 8051 assembly language programs based on arithmetic and logical instructions.
12. Generation of delay using Timers of 8051 in mode 0, 1 and 2.

Note: The term work should include a minimum **eight** experiments on hardware kits and simulation.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work, performance and oral in the practical examination.

Course Title	Short Title	Course Code
Software Application-II	**SA-II**	

Course Description:
The objective of this course is to introduce the students to the fundamental concepts of MATLAB and enable them to apply these concepts for solving real world problems. This course includes the basic structure and statements required for simple mathematical problems in MATLAB. This course provides the basic concepts of plot and other useful tools required to solve electrical the problems.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**2**	**15**	**28**	**1**

Prerequisite Course(s): Knowledge of mathematics and subject computer programming at first year engineering.

General Objectives: The objective of the course is to provide students with the essential knowledge of C language and MATLAB programming. This course will help students to use various modern tools for solving the problems of electrical engineering. The subject provides scope for practical applications of electrical engineering. The course will help students to analyze the electrical systems using the software. The course provides the effective approach for the higher studies in the efficient system design.

Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Know use of the appropriate statements available in the C and C++ language and MATLAB.
2. Implement small and medium programs of varying complexity using the most commonly used features of the language.
3. Employ good programming style, standards and practices during program development.
4. Solve the different numerical techniques and perform Matrix operations.
5. Understand and use of MATLAB for solving simple mathematical problems.
6. Plot simple, 2-D and 3-D plots using MATLAB.
7. Use modern engineering tools in MATLAB which are useful for analyzing and designing of electrical power system.

Software Application-II

(Lab Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week

Teacher should facilitate learning following lab experiments:

1. Build a simple circuit with Power System blocks and connect it to other Simulink blocks
2. Use the Powergui block and analyze static and frequency-domain response.
3. Create an electrical subsystem, simulate transients, and discretize simple circuits.
4. Single phase fully controlled converter using R and RL load using MATLAB / SIMULINK
5. Single phase AC voltage regulator using MATLAB / SIMULINK
6. Formation of Y bus matrix by inspection / analytical method using MATLAB Software
7. Formation of Z bus using building algorithm using MATLAB Software
8. Gauss Seidal load flow analysis using MATLAB Software
9. Newton Raphson method of load flow analysis using MATLAB Software
10. Fast decoupled load flow analysis using MATLAB Software
11. Fault analysis using MATLAB Software

Note: Lab file should consist of minimum **Eight** experiments.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and assignment submitted by the student in the form of journal.

Reference Books:

1. Rudra Pratap, "Getting Started With Matlab: A Quick Introduction For Scientists And Engineers" Oxford University Press.
2. Dr. Shailendra Jain, "Modeling & Simulation using MATLAB-Simulink", Wiley India.
3. Yashavant Kanetkar, "Let Us C", BPB Publications, 10/E, 2010.
4. Stephen G Kochan "Programming in C", Pearson Education, 3/E, 2004.
5. Using MATLAB, Version 6, The Math Works, Inc., 2000.
6. MATLAB function reference, The Math Works, Inc., 2000.
7. Using MATLAB Graphics, Version 6, The Math Works, Inc., 2000.
8. MATLAB Release Notes for Release 12, The Math Works, Inc., 2000.

Course Title	Short Title	Course Code
Minor Project	**MP**	

Course Description:
The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**28**	**2**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.
General Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
Course Outcomes:
Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering for innovative ideas.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Recognition of the need for, and an ability to engage in life-long learning.
8. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Minor Project

(Lab Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 50 Marks**

Practical : 2 Hrs/Week

- Every student shall undertake the Minor Project in semester VI. It is expected that the broad area of major project shall be finalized by the student in the beginning of the VI semester and Minor project undertaken may be a part of Major Project.
- Each student shall work on an approved project, a group of **05 students (maximum)** shall be allotted for the each minor project and same group may be continued for major project.
- Minor project may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.
- Each student is required to maintain separate log book for documenting various activities of minor project.
- The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of minor project. Maximum four minor project groups shall be assigned to one teaching staff.

Guide lines for ICA : Assessment of the project for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Assessment of Minor Project

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Exam Seat No	Name of Student	Project Selection	Documentation	Design /Simulation/Logic	PCB/hardware/programming	Result Verification	Presentation	Total
			5	10	10	10	10	5	50

Course Title | Short Title | Course Code

Seminar-I

Course Description: The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**2**	**14**	**28**	**2**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

General Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
4. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
5. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
6. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.
7. Practice the use of various resources to locate and extract information using offline & online tools, journals.
8. Practice the preparation and presentation of scientific papers and seminars in an exhaustive manner.

Seminar-I

(Course Contents)

Semester-VI **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

Practical : 2 Hrs/Week

1. For Seminar-I every student will individually study a topic assigned to him / her and submit a report and shall deliver a short lecture / Seminar on the topic during the term.
2. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-I. Seminar shall be related state of the art topic of his choice approved by the committee.
3. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
4. Topic of Seminar shall be registered within a two week from commencement of VI Semester and shall be approved by the committee.
5. Maximum six seminar supervision shall be allotted to each teacher.
6. At the end of semester, student should submit the seminar report (paper bound copy)in following format:
    a. Size of report shall be of minimum 25 pages.
    b. Student should preferably refer minimum five reference books / magazines/standard research papers.
    c. Format of report
        i. Introduction.
        ii. Literature survey.
        iii. Theory 1) Implementation 2) Methodology
            3) Application 4) Advantages, Disadvantages.
        iv. Future scope.
        v. Conclusion.

ASSESSMENT OF SEMINAR-I

Guide lines for ICA : Assessment of the Seminar-I for award of ICA marks shall be done by the guide and a departmental committee jointly, as per the guidelines given in **Table-B**

Title of Seminar: _____

Name of Guide: _____

Table-B

SN	Exam Seat No	Name of Student	Topic Selection	Literature survey	Report writing	Depth of understanding	Presentation	Total
			5	5	5	5	5	25