NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Syllabus for

Second Year Electrical Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER – III and IV

W.E.F 2013 – 2014

North Maharashtra University, Jalgaon
Syllabus Structure for Second year Electrical Engineering w.e.f. 2013 – 2014
SEM III

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs /wk	Tutorial Hrs/wk	Practical Hrs/wk	Total	ISE	ESE	ICA	ESE		
	Engineering Mathematics – III(TH)	A	3	1	--	4	20	80	--	--	100	4
	Power Plant Engineering (TH)	B	3	--	--	3	20	80	--	--	100	3
	Electrical Measurement – I (TH)	D	3	1	_	4	20	80	--	--	100	4
	Power System – I (TH)	D	3	--	--	3	20	80	--	--	100	3
	Electrical Engg. Materials (TH)	D	3	_	_	3	20	80	--	--	100	3
	Soft Skill – III (LAB)	C	1	--	2	3	--	--	50	--	50	2
	Power Plant Engineering (LAB)	B	--	--	2	2	--	--	50	--	50	1
	Electrical Workshop (LAB)	D	--	--	2	2	--	--	25	25 (OR)	50	1
	Electrical Measurement – I (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Electrical Engg. Materials (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
Total			**16**	**2**	**10**	**28**	**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 Second year Electrical Engineering w.e.f. 2013 – 2014
SEM IV

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs /week	Tutorial Hrs/wk	Practical Hrs/wk	Total	ISE	ESE	ICA	ESE		
	Analog & Digital Electronics (TH)	D	3		_	3	20	80	--	--	100	3
	Network Analysis (TH)	D	3	1	_	4	20	80	--	--	100	4
	Electrical Machine – I (TH)	D	3	1	_	4	20	80	--	--	100	4
	Electrical Installation Estimation &Distribution (TH)	D	3	--	--	3	20	80	--	--	100	3
	Numerical Techniques (TH)	D	3	--	--	3	20	80	--	--	100	3
	C – Programming / MATLAB(LAB)	B	1	--	2	3	--	--	50	--	50	2
	Analog & Digital Electronics(LAB)	D	--	--	2	2	--	--	50	--	50	1
	Network Analysis(LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Electrical Machines – I (LAB)	D	--	--	2	2	--	--	25	25 (PR)	50	1
	Electrical Installation Estimation & Distribution (LAB)	D	--	--	2	2	--	--	25	25 (OR)	50	1
Total			**16**	**2**	**10**	**28**	**100**	**400**	**175**	**75**	**750**	**23**

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

Course Title	Short Title	Course Code
Engineering Mathematics-III	**EM-III**	

Course Description:

This course is an advanced level Engineering Mathematics which will further strengthen the knowledge of the students who have completed Engineering Mathematics I and II in their first year which were elementary in nature. The course coverage explores Liner Differential Equation**,** function of a complex variable, Integral transforms like Laplace, Fourier, and Z-transform and vector integration. The goal of this course is to understand various differential equations and their solutions with various Integral Transform techniques, together with vector integration and their applications in engineering field.

Lectures	**Hours/Week**	**No. of Weeks**	**Total Hours**	**Credits**
	03	**14**	**42**	**04**
Tutorial	**01**	**14**	**14**	

Prerequisite Course(s): knowledge of HSC , Engineering Mathematics –I & Engineering Mathematics –II subject of first year of engineering.

Objectives of the subject:

1. Students will understand second and higher order differential equations and their solutions by general method as well as some short cut methods. Also application of differential equations to electrical engineering problems are discussed which will allow them to apply to engineering problems.
2. Students will understand function of a complex variable, definition of analytic function and its use in solving real or complex integration. Cauchy Integral theorem and Cauchy residue theorem are very important tools in solving many problems. They will learn these techniques.
3. Students will understand integral transforms such as Laplace transform (L.T.) of a function in t-domain. They will learn L.T. and their inverses of various standard functions as well as special functions such as Heaviside function, Dirac delta function, error function etc. Also they will learn the techniques to solve Initial Value Problems through Laplace transform techniques.
4. Students will understand Fourier transforms, Fourier Sine Transforms, Fourier Cosine transforms and their Inverses which are again very useful in solving Initial Value Problems.
5. Students will also learn Z-Transform and their inverses.
6. Students will understand vector integration such as line integral, surface integral etc which is very much essential in various problems.

7. Students will also learn the important theorems of vector integration like Green's, Gauss' and Stokes' theorems.
8. Students will learn Maxwell's equations which are very important for them.

Course Outcomes:

Upon successful completion this course a students will be

1. Able to apply methods of solving differential equations to the engineering problems they face in industry.
2. Able to understand analytic function of a complex variable. Able to apply Cauchy Integral theorem and Cauchy residue theorem to solve contour integrations
3. Able to apply Laplace Transform and Inverse Laplace Transform which are very useful in solving Initial Value Problems.
4. Able to apply Laplace Transform in solving problems related to their engineering field and other future courses.
5. Able to use Fourier transforms, Fourier Sine Transforms, Fourier Cosine transforms, Z transforms and their Inverses to solve various integration problems.
6. Able to use mathematics in higher studies for analysis and optimal design of system.

Engineering Mathematics – III

(Course Contents)

Semester-III **Examination Scheme:**

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

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

Tutorials : 1 Hr/Week **(ESE) End Semester Exam duration: 03 Hours**

UNIT-I: Linear Differential Equations: 09 Hours, 16 Marks

a. Solution of LDE of order n with constant coefficients.
b. Method of variation of parameters (Only Second Order).
c. Cauchy's linear equation.
d. Legendre's linear equation.
e. Applications of Linear differential equations to electrical circuits.

UNIT-II: Function of Complex Variable 09 Hours, 16 Marks

a. Analytic Functions, Cauchy-Riemann equations.
b. Cauchy's Residue theorem (Without proof)
c. Cauchy's Integral theorem and Cauchy's Integral Formula (without proof).
d. Conformal mapping, Bilinear transformations.

UNIT-III: Laplace Transform 08 Hours, 16 Marks

a. Definition and Existence of Laplace transforms.
b. Laplace Transform of elementary/standard functions.
c. LT of some special Functions viz., error, Periodic, Unit step, unit Impulse.
d. Theorems & Properties of Laplace Transform (without proof).
e. Inverse Laplace Transform.
f. Applications of LT for Network Analysis.
g. Applications of LT to solution of linear differential equation.

UNIT –IV: Fourier Transform and Z-Transform 08 Hours, 16 Marks

F) Fourier Transform:

a. Introduction to Fourier Integral theorem.
b. Fourier Transforms, Fourier Cosine Transforms, Fourier Sine Transform and their inverse.

G) Z-Transform:

a. Definition and standard properties (without proof)
b. Region of Convergence.
c. Z-Transform of standard /elementary sequences.
d. Inverse Z-transform.

UNIT-V: Vector Calculus and its applications **08 Hours, 16 Marks**

a. Introduction to Gradient, Divergence, Curl, Solenoid and Irrotational vector fields.
b. Vector integration: Line Integral, Surface and Volume integrals.
c. Gauss's Stokes and Green's Theorems (without proof).
d. Applications to Maxwell's equation.

Reference Books:

1. H.K. Dass , "Advanced Engineering Mathematics", S. Chand Publication, New Delhi.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.
3. B.S. Grewal , "Higher Engineering Mathematics", Khanna Publication, Delhi
4. Wylie C.R. & Barrett , "Advanced Engineering Mathematics", Mc Graw Hill
5. B.V. Raman, "Engineering Mathematics", Tata Mc- Graw – Hill.
6. N. P. Bali, "A Text Book of Engineering Mathematics", Laxmi Publication
7. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Power Plant Engineering	**PPE**	

Course Description:
This course provides knowledge of basic fundamentals and components required in power plant engineering, working principals and performance evaluation. The course also provides the latest technology involved in power plant engineering.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**3**

Prerequisite Course(s): Knowledge of HSC and basic fundamentals of Engineering Thermodynamics from first year Engineering.

General Objectives:
The objective of the course is to impart the fundamental knowledge about the power plants. Students develop their ability to apply the specific procedures to analyze the performance and their suitability of power plant components. The students will able to understand basic components of power plant their working principles and 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 course the students will be able to:

1. Apply basic knowledge of science, mathematics and engineering for understanding thermal studies.
2. Understand advantages, disadvantages of different types of power plant on the basis of economy and environmental aspects.
3. Understand basic working, selection of different boilers, their mountings and accessories.
4. Understand selection of water turbine for hydro electric power plant and working of diesel engine power plant.
5. Understand basic working of Nuclear power plant, social, safety and environmental considerations.
6. Do professional duties in technical field of power plants for economical development.

Power Plant Engineering

(Course contents)

Semester-III **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 1:- Thermodynamics of Power Plant **09 Hours,16 Marks**

a. Introduction to different types of fuels , classification of fuels.
b. Combustion , excess air.(No numerical treatment on combustion of fuels)
c. Thermodynamic Cycles of steam flow.
d. Rankine Cycle, Reheat cycle.
e. Regenerative cycle(numerical based on above Cycles) gas power cycles.
f. Pulverized coal firing systems, fluidized bed combustion.

Unit 2:- Thermal power plants **09 Hours,16 Marks**

a. Types of boilers and boilers mountings and accessories.
b. Heat balance sheet for boiler plant (numerical) layout of thermal power plant,
c. Site selection of thermal power plant.
d. Requirement of electric power station design.
e. Selection of turbine generator set.
f. Coal handling , Storage , preparation and feeding ,out plant handling, storage of coal at plant.

Unit 3:- Hydro electric power plant **08 Hours,16 Marks**

a. Introduction , classification of hydro electric plant.
b. Selection of site for hydroelectric plant.
c. Estimation of power available.
d. Hydraulic turbine, Pelton wheel, Francis and Kaplan turbine.
e. Performance of water turbines (numerical) cavitation in water turbines.
f. Draft tubes ,selection of hydraulic turbines.
g. Governing of turbines, safety measures in hydrostation.

Unit 4:- Nuclear power plant **08 Hours,16 Marks**

a. Introduction , plant siting , basic principles of nuclear Energy
b. Energy mass relationship, structure of the atom , radio active decay, mass defect and binding energy
c. Nuclear Chain reaction, main parts of Nuclear reactor and control , classification
d. Basic reactor system, Radioactive waste disposal ,safety features
e. Diesel power plant:- Introduction, site selection ,main components and its working , Diesel plant Efficiency, choice and characteristic of Diesel power plant.

Unit 5:- power plant Economics and Instrumentation Control. 08 Hours,16 Marks

a. Introduction ,cost analysis, Estimation and predication of load
b. Some commonly used terms, factors affecting economics of generation
c. Distribution of power ,tariffs, load shearing
d. Instrumentation and control of system electric power station
e. Measurement of chemical composition
f. Impurity measuring instruments, steam generator control

Reference Books:

1. Arora, Domkumdawar, "Power Plant Engineering" Dhanpatrai and Sons,
2. G. D. Rai , "An Introduction to Power Plant Technology", , Khanna Publication.
3. R. K. Rajput , Power Plant Engineering, S .Chand
4. J. B. Gupta, "Power Plant Engineering".
5. P. k Nag, "Power Plant Engineering", Tata Mccgraw Hills
6. S . P. Sukhatma ;- "Solar Energy"
7. Chakraborti, Soni, Gupta " A Power Plant System Engg", Dhanpatrai Publication
8. http://nptel.iitm.ac.in

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

Course Description:

This course provides a brief introduction to International system of units, dimension of Electrical quantities, methods of magnetic measurements, measurement of resistances. Construction, principle of working, torque equation ,Characteristics, error and adjustment of different types measuring instruments like PMMC, Moving iron and Electro-static instruments, ammeters, voltmeters, wattmeters and energy meters. This course also includes a brief introduction to instrument transformers.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**4**
Tutorial	**1**	**14**	**14**	

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 the knowledge of system of units, absolute and secondary measurement of electrical & magnetic quantities with different methods. In this course students will also learn available methods of measurement of electrical quantities and equipments for measurement. Students will also get the knowledge about construction, principle of operation, torque equations and different torques acting on measuring instruments. They will also learn errors & their adjustment during their use.

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. Understand the working principles of measuring instruments and their applications with extension of ranges.
4. Select instruments on basis of accuracy, sensitivity and response time in generation transmission, manufacturing, power system ,testing and energy auditing purposes.
5. Perform technical and professional duties in any type of industries.
6. Do higher studies and use of modern instruments for techno-economical developments.

Electrical Measurement-I

(Course Contents)

Semester-III **Examination Scheme:**

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

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

Tutorial : 1 Hrs/Week **(ESE) End Semester Exam duration: 03 Hours**

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

a. International system of units.
b. Dimension of Electrical quantities.
c. Absolute measurements of current and resistance.
d. Magnetic measurements: Flux meter, permeameters.
e. B-H curve of a ring specimen.
f. Hysteresis loop.
g. Iron loss test at power frequency.
h. Effect of voltage, frequency , form factor on iron loss.
i. Separation of iron losses.

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

a. Measurement of Active, Reactive and Apparent power in 3 phase circuit.
c. Effect of power factor on wattmeter reading.
d. Measurements of resistance : Classification,
e. D.C. potentiometer,
f. Kelvin's double bridge,
g. Measurements of high resistance & insulation resistance.
h. Measurement of earth resistance, factor effecting on earth resistivity

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

a. Measuring instruments (General theory)
b. Definitions and description of Static and Dynamic Characteristic of an instrument, accuracy, linearity, sensitivity, resolution, speed of response.
c. Galvanometer: Construction.
d. Deflection, controlling, damping & balancing systems of D'Arsonval, galvanometers.
e. Ballistic galvanometers.
f. Vibration galvanometers.

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

a. Ammeters and Voltmeters : Construction
b. Principle of operations,
c. Torque equations and errors of PMMC,
d. Moving iron and Electro-static instruments. Extension of ranges using short and multipliers.
e. Instrument transformers : Theory,

f. Expression for ratio and phase angle errors.
g. Design consideration and testing.
h. Precautions in using the instruments transformers.
i. Introduction to capacitive voltage transformer CVT.

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

a. Wattmeter and Energy-meter : Construction and principle of operation of electrodynamics and induction type wattmeter.
b. Construction and working of low P. F. wattmeters,
c. Errors and their compensation.
d. Construction and principle of operation
e. Torque equation for the induction type of energy-meter.
f. Error and adjustments.

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. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Power System-I	**PS-I**	

Course Description:

This course provides an introduction to generation transmission & distribution of power system. This course also provides introduction of different components of transmission system, concept and calculation of transmission line components .Course also provides knowledge of non convectional power plant, different parts and auxiliaries in power plants.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**3**

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 students with a firm grasp of the basic principles of generation of electrical power, power plant auxiliaries, transmission and distribution. This course will also help students to understand the concepts and terminologies which are used in generation and transmission systems. It is in-depth electrical course related to power generation systems.

Course Outcomes:

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

1. Apply basic knowledge of science and mathematics and understand various power generating plants.
2. Understand the factors to be consider in site selection for different power plants in view of social, environmental and safety.
3. Understand need and concept of different auxiliaries in power plants.
4. Understand hydrology, load factor, load duration curves in view of economical considerations.
5. To familiarize with different transmission systems and their components.
6. Do higher studies in generation planning, generation scheduling and load dispatch.

Power System –I

(Course contents)

Semester-III **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: G**eneration** **09 Hours, 16 Marks**

a. **Generation:** types of generating plants, basic requirements, site selection principle of working of Hydro Electric power plant, main components and auxiliary components of Hydro Electric power plant.
b. Schematic block diagram and role played by each block for Hydro Electric power plant
c. Basic requirements, site selection and principle of working of Thermal Electric power plant.
d. Main components and auxiliary components of Thermal Electric power plant.
e. Schematic block diagram and role played by each block for Thermal Electric power plant
f. Basic requirements, site selection and principle of working of Nuclear Electric power plant.
g. Main components and auxiliary components of Nuclear Electric power plant.
h. Schematic block diagram and role played by each block for Nuclear Electric power plant

Unit-II: **Non-conventional sources of energy** **09 Hours, 16 Marks**

a. Principle of working, main components and auxiliary components and of solar power plant
b. Schematic block diagram and role played by each block of solar power plant
c. Principle of working, main components and auxiliary components, schematic block diagram and role played by each block of tidal power plant
d. Principle of working, main components and auxiliary components and of MHD power plant
e. Schematic block diagram and role played by each block of MHD power plant
f. Principle of working, main components and auxiliary components of fuel cells
g. Schematic block diagram and role played by each block of fuel cells
h. Principle of working, main components and auxiliary components, schematic block diagram and role played by each block of geothermal energy

UNIT-III: **Power Plant Terminology** **08 Hours, 16 Marks**

a. Classification of power plants as Base load Peak load & Intermediate load plants.
b. Hydrograph
c. Flow duration curve

d. Category of load and load curves
e. Load duration curve.
f. Load factors.
g. Demand factor, Diversity factor.
h. Plant capacity factor, Plant use factor.

UNIT-IV: **Major Electrical Equipments In Power Plants** **08 Hours, 16 Marks**

a. Descriptive treatment of ratings of alternators.
b. Special features and field of use of alternators.
c. Descriptive treatment of ratings, special features and field of use of transformers.
d. Descriptive treatment of ratings, special features and field of use of bus bars.
e. Descriptive treatment of ratings, special features and field of use of exciters, and excitation systems.
f. Descriptive treatment of ratings, special features and field of use of CT and PT
g. Descriptive treatment of ratings, special features and field of use of metering equipments in generating stations.

UNIT-V: **Transmission System** **08 Hours, 16 Marks**

a. Importance of 3 phase overhead transmission lines in power systems & factors to be considered while planning their layout.
b. Resistance, skin effect.
c. Inductance and its estimation for two-wire-single-phase system.
d. Inductance and its estimation for 3 wire 3phase system.
e. Single and double circuit lines, with and without transposition.
f. Equal/unequal and horizontal spacing.
g. Circuit representation of lines: Classification of lines based on length as short, medium & long transmission lines.
h. Representation of transmission line as tee & pie circuit using R-L-C parameter, voltage and current relation of short & medium transmission line.

Reference Books: -

1. B.R.Gupta, “Generation of Electrical Energy”, S Chand Publication
2. William Stevenson ,”Elements of Power System Analysis” M-H international addition
3. OllE Elgerd, “Electrical Energy System Theory”, second edition, TMH.
4. J.B.Gupta, “A Course in Electrical Power System”, Dhanpat Rai and Sons’ Publication
5. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Electrical Engineering Materials	**EEM**	

Course Description: The objective of this course is to introduce the students to the fundamental knowledge of various materials used in electrical engineering. The course provides the essential knowledge for the selection of different conducting and insulating materials. This course includes the classification and application of electrical engineering materials. Applications of modern electrical engineering materials for nanotechnology and solar photovoltaic systems.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**3**

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 the knowledge of different electrical engineering materials and their applications in designing electrical equipments. The course also provides the study of thermal properties for the efficient design and long life cycle of electrical equipments.

Course Outcomes:

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

1. Classify different electrical engineering materials and testing of various electrical engineering materials.
2. Understand the electrical and thermal characteristics of conducting, semiconducting, insulating and magnetic materials for the manufacturing of electrical machines and electronic components.
3. Understand and plot the B-H curve of different magnetic materials, their suitability in manufacturing of energy efficient electrical machines.
4. Understand dielectric properties of insulating materials in static and alternating fields.
5. Recognize the materials used for solar photovoltaic systems and nanotechnology.
6. Do higher studies in solar photovoltaic material for green and clean power generation in view of sustainable development through environmental and safety aspects.

Electrical Engineering Materials

(Course Contents)

Semester-III **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: Conductors **09 Hours, 16 Marks**

a. Classification: High conductivity, high resistivity materials
b. Fundamental requirements of high conductivity materials and high resistivity materials
c. Mobility of electron in metals
d. Factors affecting conductivity and resistivity of electrical material.
e. Thermoelectric Effect: See back effect, Peltier effect.
f. Commonly used high conducting materials, copper, aluminum, bronze brass, properties, characteristics
g. Constantan, platinum, nichrome, properties, characteristics and applications
h. Materials used for AC and DC machines.

UNIT II: Semi-Conductors and Superconductors **09 Hours, 16 Marks**

a. General concepts, energy bands,
b. Types of semiconductors: intrinsic Semi-conductors, extrinsic Semi-conductors.
c. Compound semiconductor, amorphous semiconductor.
d. Hall effect, drift, mobility, diffusion in Semiconductors.
e. Semi-conductors and their applications.
f. Superconductors: Superconductivity, Properties of Superconductors, Critical field
g. Meissner effect, Type-I and type-II Superconductors.

UNIT III: Dielectrics and Insulators **08 Hours, 16 Marks**

a. Properties of gaseous, liquid and solid dielectric, dielectric as a field medium
b. Electric conduction in gaseous, liquid and solid dielectric
c. Breakdown in dielectric materials, mechanical and electrical properties of dielectric materials,
d. Effect of temperature on dielectric materials, polarization, loss angle and dielectric loss
e. Petroleum based insulating oils, transformer oil, capacitor oils, and properties.
f. Classification of insulation (Solid) and application in AC and DC machines.
g. Solid electrical insulating materials, fibrous, paper boards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling and bounding materials, fibrous, film, mica, rubber, mica based materials, ceramic materials.

UNIT IV: Magnetic Materials **08 Hours, 16 Marks**

a. Basic terms, Classification of magnetic material, diamagnetic, paramagnetic, ferromagnetic, anti- ferromagnetic and amorphous material.
b. Hysteresis loop, magnetic susceptibility, coercive force, curie temperature.
c. Magneto-striction, factors affecting permeability and hysteresis loss.
d. Common magnetic materials
e. Soft and hard magnetic materials.
f. Electric steel, sheet steel, cold rolled grain oriented silicon steel, hot rolled grain oriented silicon steel, hot rolled silicon steel sheet

UNIT V: Modern Engineering Materials **08 Hours, 16 Marks**

Materials for Electronic Components

a. Resistors, Capacitors
b. Inductors, Relays
c. Bipolar transistors, Field effect transistor (FET)
d. Integrated circuits
e. Power devices

Nano-materials

f. Introduction, Nanotechnology
g. Nano-devices.

Solar/Photovoltaic Cell

i. Introduction, Photo generation of charge carriers, p-n junction
ii. Light absorbing materials: Silicon thin films, concentrating photovoltaic.

Reference Books:

1. A.J.Dekker, "Electrical Engineering Materials".
2. S.P.Seth and P.V.Gupta, "A course in Electrical Engineering Materials", Dhanpat Rai .
3. C.S.Indulkar and S.Thiruvengadam, "Electrical Engineering Materials", S Chand Pub
4. S.P.Chhaiotra and B.K.Bhat, "Electrical Engineering Materials".
5. Electrical Engineering Materials: T.T.T.I Chennai, TMH.
6. R.K.Rajput, "Electrical Engineering Materials", Laxmi Publication.
7. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Soft Skills – III	**SK-III**	

Course Description: Through this course we have tried to prepare the students for the industry. Most companies test mathematical and logical ability through an aptitude test. This subject aims at working on these skills of a student through strategies formulae and practice exercises.

Lecture	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
	1	14	14	2
Practical	2	14	28	

Prerequisite Course(s): Fundamental knowledge of High School Mathematics.

Soft Skills – III
(Course Contents)

Semester-III **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 50 Marks**
Lectures : 1 Hrs/Week
Practical : 2 Hrs/Week

Unit-I: Arithmetic-1 **04 Hours, 10Marks**

1. **Basic Formulae**
   i. Divisibility Rules
   ii. Speed Maths
   iii. Remainder Theorem
   iv. Different Types of Numbers
   v. Applications

b. HCF, LCM and Linear Equations

i. HCF – Successive Division and Prime Factorization Methods
ii. LCM – Successive Division and Prime Factorization Methods
iii. Applications
iv. Linear Equations – Elimination Method
v. Substitution Method
vi. Applications

c. Averages and Mixtures

i. Concept of Average
ii. Faster Ways of Finding It

iii. The Allegation Method
iv. Applications

Unit-II: Arithmetic–II **04 Hours, 10Marks**

2. Percentages

i. Concept of Percentage
ii. Working with Percentages
iii. Applications

b. Profit and Loss

i. Difference between Cost and Selling Price
ii. Concept of Profit Percentage and Loss Percentage
iii. Applications

c. Time and Work

i. Basic Time and Work Formula
ii. Relation between Time and Work
iii. Applications

Unit-III: Arithmetic–III **03 Hours, 10Marks**

3. Permutations and Combinations

i. Sum Rule of Disjoint Counting
ii. Product Rule of Counting
iii. Concept of Factorial
iv. Permutations
v. Linear Permutations
vi. Combinations
vii. Circular Permutations
viii. Applications

b. Probability

i. Definition and Laws of Probability
ii. Mutually Exclusive Events
iii. Independent Events
iv. Equally Likely Events
v. Exhaustive Events
vi. Cards
vii. Dice
viii. Applications

c. Time and Distance

i. Speed
ii. Conversion Factors for Speed
iii. Average Speed
iv. Moving Bodies – Passing, Crossing and Overtaking
v. Relative Speed

vi. Boats and Streams
vii. Applications

Unit-IV: Non-Verbal Reasoning **03 Hours, 10Marks**

4. Analogies

i. Examples
ii. Applications

b. Classification

i. Examples
ii. Applications

c. Sequences

i. Examples
ii. Applications

Unit-V: Analytical Reasoning **03 Hours, 10Marks**

5. Analytical Puzzles

i. Classification Puzzles
ii. Ordering Puzzles
iii. Assignment Puzzles
iv. Applications

b. Letter and Number Series

i. Different Types of Letter Series
ii. Different Types of Number Series
iii. Mixed Series

c. Coding and Decoding

i. Letter Coding
ii. Number Coding
iii. Mixed Coding
iv. Odd Man Out
v. Applications

Guide lines for ICA:

ICA will be based on credit tests and assignments submitted by the student in the form of journal.

Reference Books:

1. R. S. Aggarwal, "Quantitative Aptitude", S. Chand Publication, New Delhi, 2012.
2. R. S. Aggarwal, "A Modern Approach to Verbal Reasoning", S. Chand Publication, New Delhi, 2012.
3. R. S. Aggarwal, "A Modern Approach to Non-Verbal Reasoning", S. Chand Publication, New Delhi, 2012.

Course Title	Short Title	Course Code
Power Plant Engineering Lab	**PPE Lab**	

Course Description:
In this laboratory, course emphasis on imparting the practical knowledge about power plant engineering, their working , safety precaution at work place.

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

Prerequisite Course(s): Knowledge of HSC and basic fundamentals of Engg. Thermodynamics from First year Engineering.

General Objectives:
The objective of the laboratory is to impart the fundamental knowledge about the power plant. Students develop their ability to apply the specific procedures to analyze the experimental results. The students will able to understand basic components of power plant their working principles and will be familiar with the use of different equipments. This makes bridge on theoretical knowledge and practical practices.

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

1. Analyze the practical data for determination of performance of power plant components.
2. Understand basic of thermal, hydroelectric, nuclear power plant.
3. Understand selection of boiler as per load requirement.
4. Understand basic working of different boilers and their mountings and accessories.
5. Understand selection of water turbine for hydro electric power plant.
6. Understand working, safety, environmental considerations of diesel power plant and nuclear power plant.

Power Plant Engineering Lab

(Lab Course Contents)

Semester: III **Examination Scheme:**

Practical: 2Hr/Week **(ICA) Internal Continuous Assessment : 50 Marks**

Teacher should facilitate learning following lab experiments:

1. Study of modern thermal power plant .
2. Study of boiler mountings and accessories
3. Demonstration and trail on diesel engine
4. Study of modern hydro electric power plant
5. Demonstration and trail on any water turbine i.e. Pelton wheel/Francis/Kaplan
6. Study of modern nuclear power plant.
7. Assignment on boiler heat balance sheet and cycles.
8. Assignment on economics of power plant
9. Assignment on instrumentation and control of power plant

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.

Reference Books:

1. Arora, Domkumdawar, “Power Plant Engineering” Dhanpatrai and Sons,
2. G. D. Rai , “An Introduction to Power Plant Technology”, Khanna Publication.
3. R. K. Rajput , Power Plant Engineering, S .Chand
4. J. B. Gupta, “Power Plant Engineering”.
5. P. K Nag, “Power Plant Engineering”, Tata Mccgraw Hills
6. S . P. Sukhatma, “Solar Energy”
7. Chakraborti, Soni, Gupta “ A Power Plant System Engg”, Dhanpatrai Publication

Course Title	Short Title	Course Code
Electrical Workshop	**EW Lab**	

Course Description:

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

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Practical	**2**	**14**	**28**	**1**

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

General Objective:

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 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 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 Workshop

(Lab Course contents)

Semester: III **Examination Scheme:**

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

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

1. **Study of different electrical symbols.**
2. **Electrical Shocks and safety precautions.**
3. **Study of different Cables:**
   a. Classification of cable, Types of three Phase cable
   b. Cable standards and specifications
   c. Insulating materials for cables, Cable joining
   d. Coaxial cable, twisted pair cable, Flat ribbon cable.
4. **Study of different wires**
   a. Size selection of wires
   b. Standard wires TRC and CTS wires
   c. Weather proof wires, Flexible wires.
5. **Study of wiring accessories:**
   a. Types of switches
   b. Types of lamp holders, ceiling rose, mounting blocks, socket outlets plugs, wooden boards
   c. main switches (ICDP/ICTP/MCB), Junction boxes, Distribution boxes, fuse boards.
6. **Selection of fuse & MCB.**
7. **Study and use of:**
   a. DC/AC voltmeter and ammeter.
   b. Analog multi-meter and Digital multi-meter for the measurement of electrical quantities.
   c. Megger, Clip-on meter.
   d. Power factor meter.
8. **Domestic wiring and Lamp circuits:**
   a. Simple circuit, series and parallel circuit,
   b. Fluorescent lamp circuits, domestic switch board wiring.
9. **Industrial Visit:** Electrical power station, electrical substation, electrical workshop, electrical process industries (minimum two visits) and its reports.

Note: The term work should include a minimum **eight** experiments. Workshop practical practices should be based on above mentioned topics. Practical should explain with model and samples on each topic.

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:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked questions on practical. Evaluation will be based answers given by students in oral examination.

Reference Books:

1. William A. Thue, “Electrical power cable engineering”
2. S L Uppal, “Electrical Wiring, Estimation and Costing”
3. Surjit Singh, “Electrical wiring, Estimation and Costing”
4. S K Bhattacharya, “Electrical wiring, Estimation and Costing”
5. B R Gupta, “Electrical Wiring, Estimation and Costing”

Course Title	Short Title	Course Code
Electrical Measurement– I Lab	**EM- I 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.

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

Prerequisite Course(s): Knowledge of HSC and Element of Electrical & Electronic Engg at First year Engineering.

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. Understand methods of measurement of power and energy.
5. Calibrate various types of instruments as per IS .
6. Do professional duties in technical field and able to use advance measuring instruments.

Electrical Measurement-I LAB

(Lab Course Contents)

Semester: III **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. Measurement of active power in three phase circuit by two wattmeter method.
2. Measurement of reactive power by two wattmeter and single wattmeter.
3. Calibration of single phase energy meter at different P.F.'s
4. Calibration of three phase two elements energy meter at different P.F.'s
5. D.C. potentiometer for calibration of ammeter and voltmeter.
6. Kelvin's double bridge: Measurement of low resistance.
7. Measurements of phase angle error and ration error of current Transformer
8. Measurements of phase angle error and ration error of Potential Transformer.
9. Epstein square.
10. Measurement of earth resistance.
11. Measurement of insulation resistance by Megger

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:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work and performance in the practical.

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.

Course Title	Short Title	Course Code
Electrical Engineering Materials	**EEM Lab**	

Course Description:
The objective of this course is to introduce the students to the fundamental knowledge of various materials used in electrical engineering. Testing of electrical engineering material and application. Testing of insulation oil as per IS.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Practical	**3**	**14**	**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 students with the essential knowledge of different electrical engineering materials and their applications in designing electrical equipments. The students will able to carry different test on electrical engineering materials to find characteristic and applications. The students will able to select the material for different applications. This course also provide a platform for further studies in solar electric power generation.

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

1. Apply basic knowledge of science and understand the characteristic of conducting material and their applications.
2. Analyze the practical data for determination of properties of materials.
3. Understand break down mechanisms for insulating materials.
4. Do testing of transformer oil as per IS.
5. Recognize the materials used for solar photovoltaic systems and nanotechnology.
6. Do higher studies in solar photovoltaic material for green, clean power generation in view of development through environmental aspects.

Electrical Engineering Material LAB

(Lab Course Contents)

Semester: III **Examination Scheme:**

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

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

1. Testing of insulating oil as per I.S.
2. Testing of solid insulating materials as per IS
3. Testing of power capacitors as per IS
4. Measurements of resistivity of conducting materials.
5. Measurements of resistivity of resistive material.
6. Study and use of Gauss meter.
7. Use of spark gap for high voltage testings.
8. To study See back and Peltier effects.
9. Study of hysteresis loop of ferromagnetic materials.
10. Study of various insulating materials.

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:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. A.J.Dekker, “Electrical Engineering Materials”.
2. S.P.Seth and P.V.Gupta, “A course in Electrical Engineering Materials”, Dhanpat Rai .
3. C.S.Indulkar and S.Thiruvengadam, “Electrical Engineering Materials”, S Chand Pub
4. S.P.Chhaiotra and B.K.Bhat, “Electrical Engineering Materials”.
5. Electrical Engineering Materials: T.T.T.I Chennai, TMH.
6. R.K.Rajput, “Electrical Engineering Materials”, Laxmi Publication.

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Syllabus for

Second Year Electrical Engineering

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER –IV

W.E.F 2013 – 2014

Course Title	Short Title	Course Code
Analog & Digital Electronics	**ADE**	

Course Description:
This course provides knowledge about electronic devices, their characteristic and ability to control high power electrical equipments. This course also provides the knowledge of digital electronics.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**3**

Prerequisite Course(s): Knowledge of mathematics and sciences at HSC & Element of Electrical and Electronic Engg at first year Engg.

General Objectives: Evolution of analog integrated circuits and digital circuits the space requirement is also reduced. The advancements in digital system design manufacturing, computer technology and information systems have caused the rapid increase in the use of digital circuits. Hence this subject is intended to learn facts, concepts, principles and applications of analog integrated circuits digital electronic. Thus, students can sharpen their skills of developing the logic using digital techniques.

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

6. Apply basic knowledge of science and engineering to understand electronic devices and circuits.
7. Understand the construction and working principles of different electronic devices.
8. Analyze the circuit for determination of circuit parameters and response of electronic devices.
9. Understand the use of different electronic devices such as BJT,FET,OPP,IC 555, PLL,etc
10. Understand and implement simple digital electronic circuits, able to use updated software and tools for continuous updating of knowledge.
11. Do higher studies in Power Electronics, Modern Drives and Flexible AC Transmission System (FACTS).

Analog & Digital Electronics

(Course Contents)

Semester-IV **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**

a. Review of rectifiers using diodes.
b. Introduction, BJT as a amplifier .
c. Analysis of CE and CC configuration using BJT,
d. Introduction to FET and FET as amplifier ,
e. Multistage amplifier,
f. Basic configuration of differential amplifier.

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

a. Operational amplifier, Op-amp parameters such as CMRR, slew rate , frequency response and gain limitations. (concept only).
b. Inverting ,non inverting amplifier.
c. Summer and substractor .
d. Op-amp applications: Integrator , differentiator .
e. Op-amp as Comparator , Schmitt trigger,
f. Instrumentation amplifier , precision rectifiers(Half wave and full wave rectifiers)
g. Waveform generation using Op-amp – sine, square , and triangular.

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

a. Types of voltage regulators only concepts
b. Series and shunt voltage regulators (Transistor series regulator),
c. Protection circuits for voltage regulators,
d. Fixed and variable voltage regulators using ICs Viz 78xx,79xx,LM723, LM317,
e. Study of VCO and PLL,
f. IC 555 and modes of operation-Astable, Monostable,

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

a. Introduction to K Map- two, three and four variables, K Map with examples
b. Concept of Latch, SR Flip flop, D type Flip flop
c. Type of triggering- age and level
d. JK flip flop, Race around condition JK Flip flop, D and T type flip flop.
e. JK Master slave flip flop, Applications
f. Opto coupler , opto isolator, opto decoder, opto encoder

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

a. Shift register, various types and concept
b. Bidirectional shift register,
c. Ripple counter(asynchronous)counter,
d. Synchronous counter only two and three bit operation
e. Twisted ring counter,
f. Up – down counter,

Reference Books:

1. Gaikwad R, "Operational Amplifier", PHI New Delhi
2. K.R.Botkar, "Integrated Circuit" , Khanna Publication,New Delhi
3. Milman Halkias , "Principles of Electronics", TMH
4. R P Jain, "Digital Electronics", TMH
5. Salivahen, "Electronic Devices and Circuit" , TMH
6. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Network Analysis	**NA**	

Course Description:

This course provides a brief introduction to students to analyze, design and synthesize network with passive and active elements. This course also includes network topologies, circuit theorems, initial conditions of network, Laplace Transform of signals, two port network parameters & Fourier Series of signals. This course provides brief description about sinusoidal steady –state analysis of R-L-C circuits

	Hours/Week	No. of Weeks	Total Hours	Credits
Lectures	**03**	**14**	**42**	**04**
Tutorial	**01**	**14**	**14**	

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 help the students in basic concepts and modern engineering methods of circuit analysis with passive and active elements. Students will be able to learn the application of Kirchoff's laws including node voltage and mesh current methods in circuit analysis, sinusoidal steady state analysis, network theorems in DC and AC cases, analysis of signal waveforms, Laplace Transformation and its applications in electric circuits, mutually coupled circuits, two port networks, Graph theory and Fourier analysis.

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

1. Identify the network, principal elements of electric circuits: nodes, loops, mesh, branches, voltage and current sources and topological description of a network.
2. Solve problems related to initial and final condition of a network.
3. Write the differential equation of first-order and second –order circuits in standard form and determine the complete solution of first-order and second order circuits excited by switched DC sources.
4. Analyze waveform using Laplace & Fourier transform.
5. Compute different theorems for networks containing linear resistors and independent and dependent sources.
6. Understand the meaning of steady state and transients by inductor and capacitor in circuits and write differential equations for such circuits.
7. Do higher studies in power system analysis under transient condition with help of modern tools.

Network Analysis

(Course Contents)

Semester-IV **Examination Scheme:**

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

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

Tutorials : 1 Hr/Week **(ESE) End Semester Exam duration: 03 Hours**

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

Introduction: Continuous and Discrete, Fixed and Time varying systems

a. Linear and Nonlinear, Lumped and Distributed systems
b. Passive and Active networks and systems
c. Independent and Dependent sources, Impulse, Step, Ramp signals
d. Sinusoidal, Square, Saw tooth signals

Coupled circuits:

e. Magnetic coupling, Concept of Self and Mutual inductance
f. Coefficient of coupling, Inductive coupling in series and parallel
g. Dot convention in Coupled coils, Modeling of coupled circuits

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

a. Source transformation.
b. Mesh and super-mesh analysis, Loop analysis.
c. Node and super-node analysis.
d. Network theorems (Application in AC circuits with independent and dependent sources**):** Superposition theorem.
e. Thevenin's and Norton's theorem.
f. Maximum power transfer theorem.
g. Millman's theorem and its application in three phase unbalanced circuit analysis.

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

Laplace transforms:

a. Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits.
b. Transient analysis of different electrical circuits with initial conditions.
c. Transient analysis of different electrical circuits without initial conditions.
d. Concept of Convolution theorem and its applications.
e. Solution of Problems with DC & AC sources.

Fourier method of waveform analysis: Fourier series and Fourier Transform (in continuous domain only)

f. Application in circuit analysis.

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

Graph theory and Networks equations:

a. Concept of Network graph, Terminology used in network graph: oriented or directed graph, branch, tree, co-tree,.
b. Incidence matrix.
c. Tie-set matrix, Cut set matrix.
d. Network Equilibrium equations in matrix form: Mesh or Loop or KVL Equilibrium equations Node or KCL Equilibrium equations.
e. Duality: Construction of dual networks by mathematical and graphical method.

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

Two port networks analysis:

a. Open circuit Impedance parameters, Short circuit Admittance parameters, Transmission parameters, Hybrid parameters
b. Inter conversion of parameters
c. Interconnection of Two port parameters: cascade connection, series connection, parallel connection
d. System and Network functions: Driving point impedance and Admittance functions, transfer impedance and admittance, voltage and current transfer ratio
e. Solution of Problems

Filter circuits: Analysis and synthesis of Low pass filters,

f. High pass, Band pass, Band reject filters.
g. All pass filters (first and second order only) using operational amplifier.

Reference Books:

1. W.H. Hyat, J.E. Kemmerly & S.M. Durbin, "Engineering Circuit Analysis", Tata Mc Graw Hill .
2. D. Roy Chowdhury, "Networks and Systems", New Age International Publishers
3. C.L. Wadhwa , "Network Analysis and Synthesis", New Age International Publishers
4. A. Sudhakar & S.S. Palli, Circuit and Networks: Analysis and synthesis, 4th edition. TMH.l
5. M.E. Valkenburg, "Network Analysis", Pearson Education .
6. D. Chattopadhay & P.C. Rakshit , "Fundamental of Electric Circuit Theory", S. Chand.
7. M. Nahvi & J.A. Edminister, Schum's outline series ,Electric Circuit, Tata Graw Hill.
8. Charles K. Alexander, Mathew. N.O. Sadiu , "Fundamental of Electric Circuits", Tata Mc Graw Hill
9. Syed A. Nasar, "Schaum's Solved Problem Series, Electric Circuits", Tata Mc Graw Hill
10. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Electrical Machines – I	**EM/C – I**	

Course Description:
This course provides knowledge about D. C. machines and transformers to familiarize students with construction, their working, operation, performance and applications.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**04**
Tutorial	**1**	**14**	**14**	

Prerequisite Course(s) : Knowledge of HSC and first year subject Element of Electrical and Electronics.

General Objective:
The course aimed at acquiring an understanding on basic principles, operation, performance and control of dc machine and transformer. The subject is helpful in the studies of technological aspects such as utilization of electrical energy, switch gear & protection, manufacturing processes & testing & maintenance of electrical machines. The subject provides scope for higher study and able to use updated software.

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

1. Apply basic knowledge of science and engineering for understanding electrical machines.
2. Understand construction, concepts, principles of operation & testing of dc machines and transformers.
3. Analyze data for qualitative and quantitative parameters to determine characteristics of machines.
4. Apply knowledge of electrical machines 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 for continuous updating of knowledge.

Electrical Machine-I

(Course Contents)

Semester-IV **Examination Scheme:**

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

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

Tutorial : 1 Hrs/Week **(ESE) End Semester Exam duration: 03 Hours**

Unit – I: **D.C .Machines** **09 Hours, 16 Marks**

a. Introduction of D C machine and its construction .
b. Construction of field and armature winding, Type of armature windings.
c. **D.C. generator:** Basic principles of working, e.m.f. generation, Classification of DC generator.
d. Process of commutation, types of commutation, Causes of bad commutation and remedies.
e. Characteristics and applications of different types of d.c. generator.
f. Losses and power stages in dc generator.
g. Armature reaction, effect and estimation of amp-turns.

Unit – II: **D.C. Motors** **09 Hours, 16 Marks**

a. Working principle of DC motor & significance of back e.m.f.
b. Need of starter and reversing direction of rotation.
c. Classification of DC motors and torque equitation.
d. Speed control by armature voltage and field control.
e. Characteristics and applications of different types of d.c. Motors.
f. Power stages in DC motor & Condition of maximum efficiency .

Unit – III: **Testing of DC Motors** **08 Hours, 16 Marks**

a. Testing of d.c. Machines: Type of tests like routine, type test and supplementary test.
b. Brake test.
c. Swinburne's test.
d. Regenerative or Hopkinson's test .
e. Field's test for series motor.

Unit – IV: **Single Phase Transformers** **08 Hours, 16 Marks**

a. Constructional working details, arrangements of core and coils in shell type and core type transformer.
b. EMF equation, voltage and current ratios, concept of leakage flux and its effect.
c. Leakage reactance and leakage impedances of transformer windings, voltage regulation.
d. General phasor diagrams on no load and load.
e. Open and short circuit test on transformer.
f. Exact and approximate equivalent circuit referred to either side.

g. Efficiency, maximum efficiency, all day efficiency transformer rating, Autotransformers.

Unit – V: Three – Phase Transformers 08 Hours, 16 Marks

a. Poly-phase Transformers-connecting a bank of three identical single phase transformer for three phase transformation,
b. Comparison between a bank of three identical single phase transformers and a single three phase transformer.
c. Standard connections for three phase transformers, their voltage phaser diagrams, phaser groups, suitability of particular connection for supplying unbalanced loads.
d. Factor affecting the choice of connection.
e. Parallel operation of three phase transformers, tap changer on transformer.
f. Open delta or V-V connection, application and vector diagram.
g. Scott connection for three phase to two phase transformation and vice-versa ,applications.
h. Labeling and polarity test of three phase transformer.

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. P.C.Sen. "D.C. Machines", TMH.
5. Nagrath and Kothari "Electric Machine" –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. http://nptel.iitm.ac.in

Course Title | Short Title | Course Code

Electrical Installation Estimation and Distribution | **EIED**

Course Description:

This course provides the knowledge about the various aspects of transmission & distribution system. The course includes the study of different components of transmission & distribution system, types of tariffs, earthing systems, different types of modern advanced tools such as PLC, SCADA to control system efficiently & economically, & basics of illumination engineering.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**42**	**03**

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 students with a firm grasp of the essential principles of a.c. and dc transmission and distribution systems. This course will help student to understand the concepts and terminology that are used in illumination engineering, designing & installation of electrical power system. The subject provides scope for practical applications of electrical power system engineering. The course provide bridge for higher studies in efficient and techno commercial aspect of power system.

Course Outcomes:

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

1. Understand various methods of power distribution system.
2. Analyze parameter and design of different transmission components.
3. Draw substation layout as per the requirements, design of conductor size and components of systems as per IS.
4. Prepare the detailed wiring, earthing estimates of residential, commercial building and industrial sectors.
5. To familiarize with different scheme of illumination systems.
6. Discharge the professional duties in the field of electrical installations.

Electrical Installation Estimation and Distribution

(Course Contents)

Semester-IV **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: **Supply Systems** **09 Hours, 16 Marks**

a. Supply Systems: Typical A.C. Supply Scheme
b. A.C. transmission, D.C. transmission and comparison between them based on technical, stability and cost effectiveness.
c. Types of transmission: overhead transmission, underground transmission and comparison between them.
d. Various systems of transmission: Dc systems : Two wire dc, two wire dc with midpoint earthed, dc three wire system.
e. Single phase ac systems : Single phase two wire, single phase two wire with midpoint earthed, single phase three wire system .
f. Two phase ac systems: Two phase three wire system, two phase four wire system .
g. Three phase ac system : Three phase three wire system, three- phase four wire system.

UNIT-II: **Overhead Transmission Line Components** **09 Hours, 16 Marks**

a. The support –poles, towers, and their types, cross arm and clamps, guys and stays.
b. Conductors-characteristics of conductor material, types of conductor- solid conductor, bundle conductor, concentrically standard conductor (ACA, ACSR conductor).
c. Insulators – types (pin, strain, shackle and suspension insulator), failure of insulators, potential distribution over suspension insulator string.
d. String efficiency, method of improving of string efficiency.
e. Underground cables **;** classification , construction of cable, requirements of insulating materials , insulation resistance.
f. capacitance dielectric stress in single-core/multi-core/ sheathed /armored cables.
g. Grading of cables – capacitance grading and inter sheath grading.

UNIT-III: **Earthing and Design of Distribution System** **08 Hours, 16 Marks**

a. Earthing : System earthing, Equipment earthing, method and material for earthing.
b. Design of distribution system **:** General design consideration for distribution system.
c. Connection scheme of distribution system.
d. Requirements of distribution system.
e. Service mains, feeders,distributors.
f. A.C. distribution and D.C Distribution
g. Feeder design based on Kelvin's law .

UNIT-IV: **Design and Estimation** **08 Hours, 16 Marks**

a. IE rules related to estimation and installation.
b. Design and estimation of installation of residential buildings, commercial, industrial heads as per IE rules .
c. Different types of tariffs.
d. Introduction to SCADA and PLC panels.

UNIT-V: **Illumination** **08 Hours, 16 Marks**

a. Illumination : nature of light , definitions –plane angle , luminous flux luminous intensity , illuminance and their units, luminous efficiency.
b. Laws of illumination – inverse square law and Lambert's cosine law , polar curves.
c. Requirements of good lighting scheme: Polar curves, direct, indirect , semi direct , semi-indirect lighting
d. Design of lighting scheme : factors to be considered , working plane space to height ratio, absorption factor, maintenance factor , depreciation factor , coefficient of utilization
e. Design of illumination schemes for industrial workshops assembly halls, street lighting.
f. Design of flood lighting schemes**:** factors like reflection factor , waste light factor and beam factor and design of such schemes for typical installation.

Reference Books:

1. J.B.Gupta, "Transmission and Distribution" S.K.Kataria and Sons, New Delhi.
2. S.L.Uppal , "Electrical Wiring , Estimation and Costing" ,Khanna Publishers, New Delhi.
3. V.K.Mehta, "Principle of Power System" ,S.Chand, New Delhi
4. S.L.Uppal, "Electric Power", Khanna Publishers, New Delhi.
5. H.Pratap , "Art and Science of Electrical Utilization" ,Dhanpat Rai and Sons, New Delhi.
6. B.D.Arora, "Electric Wiring, Estimating and Costing", New Heights, New Delhi
7. S.K.Bhattacharya, "Electrical Estimation and Costing"
8. I.E.Rules.
9. http://nptel.iitm.ac.in

Course Title	Short Title	Course Code
Numerical Techniques	**NT**	

Course Description:
This course provides knowledge of numerical methods and optimization technique.

Lecture	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	3	**14**	**42**	**3**

Prerequisite Course(s) : Knowledge of mathematics and science at HSC & First Year Engineering.

General Objectives:
To familiarize with number system in computations, polynomial equations, concept of roots of an equation & methods to find the same. To study various differentiation & integration methods. To understand the tradeoff between programming ease, computation time, data storage, truncation and round off errors.

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

1. Solve polynomial and transcendental equations,
2. Solve linear algebraic equations, simultaneous equations.
3. Solve Interpolate by Lagrange's & Newton methods.
4. Solve ordinary differential equations by using Euler's method, Runge Kutta method, Taylor's Method and predictor - corrector method.
5. Develop computer program for above methods.
6. Do higher studies in power system such as load flow study and power system optimization.

Numerical Techniques

(Course Contents)

Semester-IV **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**

a. Number systems & errors in digital computations,
b. Transcendental & polynomial equations,
c. Concept of roots of an equation & methods to find the same.
d. Secant method,
e. Newton- Raphson method,
f. Regula-Falsi method.
g. Method of matrix Inversion (Shipley inversion method)

Unit II **09 Hours, 16 Marks**

Linear algebraic simultaneous equations:

a. Gauss method, ,
b. Gauss Elimination,
c. Gauss Jordan,
d. Jacobi Iteration,
e. Triangular Factorization (L-U Factorization),
f. Gauss Seidal method.

Unit III **08 Hours, 16 Marks**

Interpolation:

a. Newtons's forward and backward interpolation formula
b. Gauss's forward and backward interpolation formula
c. Lagrange & Newton interpolations,
d. Central difference operators, interpolating polynomials using finite differences,
e. Least squares approximation.

Unit IV **08 Hours, 16 Marks**

Differentiation & Integration:

a. Numerical differentiation methods based on interpolation,
b. Finite differences, undetermined coefficients.
c. Integration using Simpson's 1/3 rule
d. Trapezoidal rule.

Unit V **08 Hours, 16 Marks**

Ordinary differential equations and their solutions:

a. Euler's method,
b. Taylor series method,
c. Runge-Kutta methods,
d. predictor-corrector methods.

Reference Books:

1. Jain & Iyengar, "Numerical Methods for Scientific & Engineering Computation", 3rd edition, New Age international.
2. S.K.Gupta, "Numerical Methods for Engineers", New Age international.
3. Anita, "Numerical Methods for Scientists & Engineers", Tata McGraw Hill.
4. S.S. Shashtry, "Introductory Methods of Numerical", Tata McGraw Hill.
5. Rajaraman, "Numerical Methods & Computations", Tata McGraw Hill.
6. Kanti Swarup , P. K. Gupta, Man Mohan, "Operation Research", Sultan Chand & Son.
7. Yashwant Kanitkar., "Let us C".

Course Title	Short Title	Course Code
C – Programming / MATLAB	**CP/MATLAB**	

Course Description:
The objective of this course is to introduce the students to the fundamental concepts of the C and C++ programming language, 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**	**14**	**14**	**2**
Practical	**2**	**14**	**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.

C – Programming / MATLAB

(Course Contents)

Semester-IV **Examination Scheme:**

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

Lectures : 1 Hrs/Week

Practical : 2 Hrs/Week

Unit-I C Language Review: **03 Hours**

a. Algorithms, flowcharts
b. Data types in C
c. The C character set: Constants, Variables and keywords.
d. The decision control structure

Unit-II Program Development Concepts: **03 Hours**

a. The loop control structure
b. Functions and pointers
c. Arrays

Unit-III Numerical computational techniques 1 **03 Hours**

a. Solution of transcendental & polynomial equation.
b. Solution of bisection method.
c. Solution of Newton Raphson method.

Unit-IV Numerical computational techniques 2 **02 Hours**

a. Solution of secant method.
b. Solution of linear equations using Gauss elimination method and Gauss-Jordan methods.
c. Numerical integration and differentiation: trapezoidal rule Simpson's 1/3 and 3/8 rule.

Unit-V MATLAB **03 Hours**

a. Introduction, Basics of MATLAB
b. Working with arrays of numbers
c. Creating and printing simple plots
d. Creating and executing a Script file, function file.
e. Interactive computations: Matrices and vectors, Matrix and array operation.
f. Graphics: Basic 2-D plots, 3-D plots.

C – Programming / MATLAB
(Lab Course Contents)

Teacher should facilitate learning following lab experiments:

1. Bisection Method program.
2. Secant Method program.
3. Newton Raphson Method program.
4. Gauss Elimination Method Program.
5. Gauss seidal Method Program.
6. Simpson`s 1/3 rd and 3/8 th rule program.
7. Arithmetic operations on matrix using MATLAB.
8. Plot the simple, 2-D and 3-D plots using MATLAB.
9. Find the roots of polynomial equations using MATLAB.
10. Find eigenvalues and eigenvectors, LU factorization.

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. Yashavant Kanetkar, "Let Us C", BPB Publications, 10/E, 2010.
2. Stephen G Kochan "Programming in C", Pearson Education, 3/E, 2004.
3. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press, 2009.
4. Jain & Iyengar, "Numerical Methods for Scientific & Engineering Computation", 3rd edition, New Age international.
5. S.K. Gupta, "Numerical methods for Engineers", New Age international.
6. Anita, "Numerical methods for scientists & Engineers", Tata McGraw Hill.
7. Using MATLAB, Version 6, The Math Works, Inc., 2000.
8. MATLAB function reference, The Math Works, Inc., 2000.
9. Using MATLAB Graphics, Version 6, The Math Works, Inc., 2000.
10. MATLAB Release Notes for Release 12, The Math Works, Inc., 2000.

Course Title	Short Title	Course Code
Analog & Digital Electronics Lab	**ADE Lab**	

Course Description:
This lab course provides knowledge about electronic devices, their characteristic and ability to control high power electrical equipments. This course also provides the knowledge of digital electronics

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**3**	**14**	**28**	**1**

Prerequisite Course(s): Knowledge of mathematics and sciences at HSC & FE level and basic electronics

General Objectives: Evolution of analog integrated circuits and digital circuits the space requirement is also reduced. The advancements in digital system design manufacturing, computer technology and information systems have caused the rapid increase in the use of digital circuits. Hence this subject is intended to learn facts, concepts, principles and applications of analog integrated circuits digital techniques. Thus, students can sharpen their skills of developing the logic using digital techniques.

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

1. Apply basic knowledge of science and engineering to understand electronic circuits.
2. Conduct practical and able to analyze the data for determination of circuit parameters and response of electronic devices.
3. Understand the use of different electronic devices such as BJT,FET,OPP,IC 555, PLL, etc
4. Understand and implement simple digital electronic circuits, able to use updated software and tools for continuous updating of knowledge.
5. Do higher studies in Power Electronics, Modern Drives and Flexible AC Transmission System (FACTS).

Analog & Digital Electronics Lab
(Lab Course Contents)

Semester-IV **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 50 Marks**
Practical : 2 Hrs/Week

Teacher should facilitate learning following lab experiments:

1. Op-amp as square & sine wave generator using IC 741.
2. Op-amp as comparator & Schmitt trigger IC 741.
3. Instrumentation amplifier using 3 Op-amps .
4. IC 555 application – Astable, Monostable, Square wave generator, Square counter.
5. IC 565 application ,calculation of lock range and capture range.
6. Study of JK flip flop IC 7476.
7. Study of binary counter using IC 7493.
8. Study of up down counter using IC 74492.
9. Study of IC 723 as low / high voltage regulator.
10. IC 7805 used as fixed voltage regulator, elevated voltage and current, constant current source.

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.Gaikwad R, “Operational Amplifier”, PHI New Delhi
2.K.R.Botkar, “Integrated Circuit” , Khanna Publication,New Delhi
3.Milman Halkias , “Principles of Electronics”, TMH
4.R P Jain, “Digital Electronics”, TMH.

Course Title	Short Title	Course Code
Network Analysis Lab	**NA Lab**	

Course Description:
This laboratory provides introduction to Electrical engineering students with a focus on circuit components and analysis. This laboratory provides comprehensive study of fundamental concepts of ac and dc networks, network theorems, measurement of circuit parameters and transient response of simple RLC circuits.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**14**	**28**	**1**

Prerequisite Course(s): Knowledge of HSC & subject Element of Electrical & Electronic Engg. at first year Engineering.

General Objectives:
The objective of the lab course is to provide students with the essential principles of ac and dc electric circuit and basic circuit parameters. This course will help student to understand concept of network theorems, transient response of series and parallel RLC circuits and coupled circuits and two port networks. This course will help the student to apply the network concepts to solve the real life electrical engineering problems. The scope of this course is very wide and it is very important for the further studies and research work.

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

1. Introduce the concept of circuit elements, lumped circuits, circuit laws and reduction.
2. Analyze the electric network concepts, topology and equations.
3. Know the solution of differential equations & Laplace transform.
4. Use the knowledge of different theorems, pole zeros & different types of network.
5. Relate the knowledge of Z, Y, H parameters, Fourier series to understand the behaviors of network.

Network Analysis Lab

(Lab contents)

Semester-IV **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. Verifications of Thevenin's Theorem for two port network.
2. Verification of Norton's Theorem for two port network.
3. Verification of Superposition Theorem for two port network.
4. Pole and Zero plot of one port network.
5. Measurement of Z parameter of two port network.
6. Measurement of Y parameter of two port network.
7. Measurement of ABCD parameter of two port network.
8. To plot frequency response of series RLC circuit.
9. To plot frequency response of parallel RLC circuit.
10. Study of filters

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.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical out of above practicals. Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. M.E. Van Valkenberg , "Network Analysis" , Third edition, Printice Hall of India.
2. William Hayt, Jack Kemmerly, "Engineering Circuits Analysis", Fifth editions, McGraw Hill International edition.
3. D. Roy Choudhary, "Networks and Systems", New Age International.
4. Franklin Koo, "Network analysis and Synthesis", New Age International
5. Shyam Mohan and sudhakar, "Network Analysis", TMH Publications.

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

Course Description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic , performance and testing of DC Machines, Speed control DC Motor and use of other measuring equipment their class of accuracy. It also give the platform to understand construction, working ,performance , testing and selection of transformer.

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

Prerequisite Course(s): Knowledge of HSC and First year Engineering.

General Objectives:

The objective of the laboratory is to impart the fundamental knowledge of Machines and transformers. 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 DC machines and application in process and manufacturing. Application of transformer in power system. 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 students will be able to:

1. Understand constructional details of dc electrical machines and transformer.
2. Understand specifications of machines.
3. Conduct practicals for determination of characteristics of different type of generator , motors and transformers.
4. Able to analyze the test data for practical for applications, design and manufacturing processes.
5. Understand methods of speed control and starters for dc motors.
6. Select motor and transformer based on technical specifications, safety precautions and application.
7. Do professional duties in technical field for economical development.

Electrical Machine-I Lab

(Lab Course Contents)

Semester-IV **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 magnetization, external , internal characteristics and critical field resistance of d. c. shunt generator
2. Determination of external characteristics of d.c. compound generator as i) differential compound, ii) cumulative compound generator.
3. Speed control of D.C shunt motor by armature and field control.
4. i) Study of 3 and 4 point starters. ii) Reversal of motor rotation of D. C. motor.
5. Determination of performance characteristic of DC series motor by direct load.
6. Swinburne's test on DC shunt Motor: Determination of losses & efficiency.
7. Polarity and Ratio test on single phase transformer/three phase transformer.
8. Determination of performance of single phase transformer by direct load test.
9. Determination of performance of single phase transformer by conducting Open circuit and short circuit test.
10. Parallel operation of two single phase transformer.
11. Study of phaser and vector group of three phase transformer.
12. Scott connection of two single phase transformer on no load and at balanced load.

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:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work and performance in the practical.

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. P.C.Sen. "D.C. Machines", TMH.
5. Nagrath and Kothari "Electric Machine" –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.

Course Title Short Title Course Code

Electrical Installation, Estimation and Distribution Lab EIED Lab

Course Description:

This course provides an introduction to generation transmission & distribution of power system also in this course study of different components of transmission system, types of earthing systems & Different types of latest control system such as PLC, SCADA, Design of transmission line components and different parts

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

General Objectives:

The objective of the course is to provide students with a firm grasp on the essential principles of transmission and distribution. This course will help student to understand the concepts and terminology which are used in transmission and distribution systems. It is not an in-depth electrical course but, rather a course aimed at acquiring an understanding of basic principles that are used in electrical engineering.

Course Outcomes:

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

1. Analyze and design of different transmission components.
2. Design of conductor size and components of systems
3. Describe concept and conditions of different interconnected systems in transmission systems
4. Understand construction and working different earthing systems
5. Familiarize with different illumination systems.
6. Understand safety precautions in electrical installations.

Electrical Installation, Estimation and Distribution Lab

(Lab Course Contents)

Semester-IV **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 and drawing sheets:

1. Transmission line components : Five insulators –one piece pin, three piece pin type , suspension insulator (one disc) string insulator (one disc), shackle insulator; towers for single circuit and double circuit lines; lightening arrestor, stays, clamps, pin; typical pole including service mains, HT, LT lines supporting pole , 'H' type pole.
2. Distribution substation; Two views (front view and side view) of distribution substation layout ; single line diagram, pipe earthing , plate earthing.
3. Wiring diagrams and symbols**:** minimum 25 symbols as per IS standards. Any one circuit diagram out of the following: 1) Rotor resistance starter, 2) Automatic star /delta starter, 3)Maximum demand indicator.
4. Project on illumination design of laboratory / workshop or small scale industrial establishment along with estimation.
5. Project on electrification of given area showing distributors, feeders and substations.

The drawing sheet along with report on each 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 drawing sheet and journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked questions on practical. Evaluation will be based answers given by students in oral examination.

Reference Books:

1. J.B.Gupta, "Transmission and Distribution" S.K.Kataria and Sons, New Delhi.
2. S.L.Uppal , "Electrical Wiring , Estimation and Costing" ,Khanna Publishers, New Delhi.
3. V.K.Mehta, "Principle of Power System" ,S.chand, New Delhi
4. S.L.Uppal, "Electric Power", Khanna publishers, New Delhi.
5. H.Pratap , "Art and Science of Electrical Utilization" ,Dhanpat Rai and Sons, New Delhi.
6. B.D.Arora, "Electric Wiring, Estimating and Costing", New Heights, New Delhi
7. S.K.Bhattacharya, "Electrical Estimation and Costing"
8. I.E.Rules.