

CURRICULUM FOR

DIPLOMA IN

ELECTRICAL ENGINEERING

SEMESTER I, II, III, IV, V & VI

PROGRAMME STRUCTURE

SET I

Semester - I

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN102	Engg. Maths - I	4	2	-	6	75	25			100
GN103	Applied Physics-I	4		2	6	75	25	-	50	150
GN106	Basic Engg.Skills	-	-	6	6	-	-	50	100	150
GN105	Comp. Fund & App.	-	-	4	4	-	-	50	50	100
GN203	Environmental Studies	3			3	75	25	-	-	100
Total		11	2	12	25	225	75	100	200	600

Semester - II

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN202	Applied Physics-II	4	-	2	6	75	25	-	50	150
GN201	Engg. Maths II	4	2	-	6	75	25	-	-	100
GN104	Applied Chemistry	3		2	5	75	25	-	50	150
GN101	Communication skills	-	-	2	2	-	-	50	50	100
GN205	Engg. Materials	4	-		4	75	25	-	-	100
GN204	Engg. Drawing	2	-	4	6	-		50	50	100
Total		17	2	10	29	300	100	100	200	700

SEMESTER I

GN 102 ENGINEERING MATHEMATICS- I

1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-102	L	T	P	C	TH	TM	TW	PR/OR	100
Engineering Mathematics	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENTS

Unit 0 Fundamentals of algebraic mathematical operations

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

Unit 1 Co-ordinate Geometry/ Analytic Geometry;

Purposes/Applications of Co-ordinate Geometry. Coordinate systems. *Straight Line*-Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.

Unit 2 Trigonometry

Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles(only $2A$). Sum & product formulae. Sine, Cosine rules. Solution of triangles

Unit 3 Limits & Functions

Functions- constants, variables. Kinds of functions (question not to be asked). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)

Unit 4 Differential Calculus

Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.

Unit 5 Application of derivatives

Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	14	20
2	Trigonometry	17	16
3	Limits & Functions	8	12
4	Differential Calculus	15	20
5	Application of derivatives	10	07
		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

GN 103 APPLIED PHYSICS-I

1. RATIONALE:

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics. This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)				Total Credit	Examination Scheme				Total Marks
						Theory Marks		Practical Marks		
GN-103 Applied Physics I	L	T	P	C	TH	TM	TW	PR/OR	150	
	4	-	2	6	75	25	50	-		

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 UNITS & DIMENSIONS

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

Unit 2 KINEMATICS

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.
 Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration. $V=u+at$, $S=ut + \frac{1}{2} at^2$, $v^2 = u^2 + 2as$. Velocity- time diagram, Motion under gravity.

Unit 3 PROPERTIES OF MATTER

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

Unit 4 HEAT

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of coefficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor
Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

Unit 5 ELECTROSTATICS

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

Unit 6 MAGNETISM

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current (no derivation), Force acting on straight conductor placed in Magnetic Field (no derivation).

Unit 7 (A) LAWS OF FORCES & FRICTION (MECHANICAL AND ALLIED GROUPS)

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components. Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose(only qualitative aspects)

OR

UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)

Energy Band structure of electronic material(conductor , semiconductor and insulator)
Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.
Types of semiconductors P- type and N- type, Structure of P- type and N- type, Extrinsic semiconductor using pure Si and Ge semiconductors.
Types of carriers; N- type and P- type
Process of recombination of carriers.
Formation of P-N junction and depletion region.

4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	OR		
7B	Semiconductors	8	12
	Total	64	75

7A-Mechanical and allied branches

7BFor Electronics and allied branches

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

1. RATIONALE

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks	Practical Marks			
GN-105	L	T	P	C	TH	TM	TW	PR/OR	100
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	

Minimum passing % : Theory 40%

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;
PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT 1 Computer Fundamentals

1. Introduction to Computer
2. History, Evaluation, Classification and Generations of computers
3. Organisation of the Computer System
4. Hardware
 - Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner
 - Printers.
5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

UNIT 2 Operating System

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

UNIT 3 Application Software

1. MS Word

- Introduction
 - Starting MS Word
 - Creating, saving and opening a document
 - Editing commands-Cut, Copy, Paste, Paste Special
 - Text Formatting, Bullets and Numbering, Borders and shading etc.
 - Tabs, Style, Views
 - Insert Table, Picture, OLE Objects, etc.
 - Checking Spelling and Grammar, Thesaurus
 - Page Layout & Printing
 - Mail Merge.

2. MS Excel

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet
- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

UNIT 4 The Internet

Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Email

- Manage an E-mail Account
E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	1	Identify Input and output devices
2	1	Calculate capacity of different storage device
3	2	Identify OS and different application software s loaded on that OS
4	3	Load Windows operating system. Configure and load relevant device drivers

Directorate of Technical Education, Goa State

5	4	<p>Practice on Windows 95/98/2000 ;</p> <ul style="list-style-type: none"> o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows o Study of file organization: creating, copying, moving, renaming and deleting o Practice on Windows Accessories- Notepad, Word Pad and Paint o Editing document & formatting text, Previewing and printing document/Image file o Practice on Windows Explorer o Recycle bin o Shutting down windows
6	4	<p>Practice on MS-Word ;</p> <ul style="list-style-type: none"> o Create and format document o Edit and Modify text- changing font size type and style o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text o Open save and print a document o Insert, modify table o Insert graphics o Mail merge
7	5	<p>Practice on Microsoft Excel</p> <ul style="list-style-type: none"> o Create, save & format worksheet o Open and save worksheet file o Edit & modify data o Use formula and functions o Split windows and freeze pans o Data sort and security features o Create, edit, modify and print worksheet. o Create and edit charts
8	5	<p>Practice on PowerPoint</p> <ul style="list-style-type: none"> o Create, edit, insert, move, slides o Open and save presentation o Insert picture, audio slide layout, action button o Apply custom animation o Present slide show
9	6	<p>Practice on:</p> <ul style="list-style-type: none"> o Identification of type of Account. o Connecting to internet o Dial up access o Web browsing o Searching websites o Information searching o Email services o Creating email accounts & Receiving and sending mails

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6 th Edition, 2005 ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi, ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi, ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi, ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3 rd Edition, ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003 ISBN: 8186340742

GN106 BASIC ENGINEERING SKILLS

1. Rationale:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a thorough exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

2. Teaching And Examination Scheme

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	PR/OR	TW	
(GN106) Basic Engineering Skills	0	0	6	6	-	-	50	100	150

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

3. Detailed Course Contents

Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid

Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.

Unit 2: Fitting Workshop Practice

Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.

Unit 3: Carpentry Workshop Practice

Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.

Unit 4: Electrical Workshop Practice

Directorate of Technical Education, Goa State

Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.

Unit 5: Basic Electronics Workshop Practice

Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)

Unit No.	Topic	Hours/ Semester
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	<i>Total</i>	96

GN203 ENVIRONMENTAL STUDIES

1. RATIONALE

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)				Total Credits	Examination Scheme				Total Marks
	L	T	P	C		TH	TM	TW	PR/OR	
GN203 Environmental Studies	3	-	-	3		75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hrs.

3. DETAILED COURSE CONTENT

Unit 1 Multidisciplinary Nature Of Environmental Studies.

Definition, scope and importance. Need for public awareness.

Unit 2 Natural Resources

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.

- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
 - Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.
- Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

Unit 3 Ecosystems.

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

Unit 4. Biodiversity And Its Conservation.

Introduction – Definition: genetic, species and ecosystem diversity.

Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit 5. Environmental Pollution.

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

Unit 6. Social Issues And The Environment.

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit 7. Human Population And The Environment.

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.

Unit 8. Field Work.

Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. (Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	

SEMESTER II

GN 101 COMMUNICATION SKILLS

1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
GN-101 Communication Skills		-	2	2	-	-	50	50	100

Minimum passing % : Practical 40%

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 - Fundamental of Communication skills

Definition, components (message, sender, receiver, transmission medium and protocol), types (verbal & non-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications (verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

Unit 2 – Presentation Skills

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

Unit 3 - Technical Reports, Letter Writing, CVs

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

Unit 4 - Soft Skills

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

Unit 5 - Language Workshop

The Reading, Listening, Writing, Speaking Skills will be tested

1. Reading Skills:

Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

2. Listening Skills:

Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

3. Writing Skills:

- a) Students to write on any given topic
- b) Students to compose their own stories
- c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

4. Speaking Skills:

- a) Students to speak on any given topic
- b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

GN 104 APPLIED CHEMISTRY

1. RATIONALE

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks	Practical Marks			
GN-104 Applied Chemistry	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks;
PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 Atomic Structure and Chemical Bonding

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1st three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, CaCl₂) covalent compounds (Cl₂, O₂, N₂, CO₂) and coordinate compounds (O₃, SO₂).

Unit 2 Electrochemistry

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series-concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous CuSO₄ using platinum electrodes iv. aqueous CuSO₄, using copper electrodes);

UNIT 3 Water and its treatment

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation (no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

Unit 4 Corrosion and Its Control

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

Unit 5 Lubricants

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	48	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permanganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

6. SUGGESTED LIST OF ACTIVITIES

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

7. SUGGESTED LEARNING RESOURCES

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Publishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

GN201 ENGINEERING MATHEMATICS- II

1. RATIONALE :

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME :

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-201 Engineering Mathematics-II	L	T	P	C	TH	TM	TW	PR/OR	100
	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;
PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENT :

<p>Unit 1 Determinants Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule</p>
<p>Unit 2 Binomial Theorem - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).</p>
<p>Unit 3 Mensuration - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule</p>
<p>Unit 4 Matrices Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.</p>
<p>Unit 5 Integral Calculus Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration, area under a plane curve, volume of revolution.(simple sums only)</p>

Unit 6 Differential Equations

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems

Unit 7 Statistics (Mechanical and Allied Engg. Branches)

. Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation

OR

Unit 7 Complex Numbers. (Electronics engg and Allied branches)

Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity , hyperbolic functions

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY) :

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	5	7
2.	Binomial Theorem	7	10
3.	Mensuration	7	10
4.	Matrices	11	08
5.	Integral Calculus	17	20
6.	Differential equations	08	10
7.	Statistics	09	10 \$
OR			
7	Complex Numbers	09	10 #
	Total :	64	75

\$- for Mechanical and allied branches

- For Electronics and allied branches

5. SUGGESTED LEARNING RESOURCES :

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

GN 202 APPLIED PHYSICS-II

1. RATIONALE:

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks	Practical Marks			
GN-202 Applied Physics-II	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 FORCE, WORK, POWER, AND ENERGY

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

Unit 2 CURRENT ELECTRICITY

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire.

Principle of potentiometer. Comparison of EMF of a given cell by single cell method.

Comparison of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

Unit 3 ELECTROMAGNETISM

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

Unit 4 LOGIC GATES

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10
Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

Unit 5 SOUND

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.
Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

Unit 6 CIRCULAR MOTION AND GRAVITATION

Defination of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Defination and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

**Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES
(MECHANICAL AND ALLIED GROUPS)**

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

**Unit 7 (B) RECTIFIERS
(ELECTRONICS AND ALLIED GROUPS)**

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation, $((V_{NL} - V_{FL}) / V_{FL}) \times 100$
Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation
Bridge rectifier, working, input and output waveforms, percentage regulation

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK, POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARENESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	64	75

7A- for Mechanical and allied branches

7B- For Electronics and allied branches

5. LIST OF EXPERIMENTS

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	

GN 204 ENGINEERING DRAWING

1. RATIONALE:

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
	L	T	P		TH	TM	TW	PR/OR	Total Marks
GN-204 Engineering Drawing	2	-	4	6	-	-	50	50	100

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENT

<p>Unit 1 Introduction</p> <ul style="list-style-type: none"> • Importance of Engineering drawing as a means of communication. • Introduction to drawing equipment, instruments and their uses. • Planning of drawing sheet as per I.S. 696 - 1972. • Indian standard practices of laying out and folding of drawing • Different types of lines used in engineering drawing. • Importance of scale in Engineering Drawings. • Lettering

Unit 2 Dimensioning techniques and standard conventions

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

Unit 3 Engineering Curves & Shapes

- Construction of an Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
 - Ellipse- by focus & directrix method and arcs of circles method
 - Parabola- by focus & directrix method and rectangle or oblong method
 - Hyperbola- by transverse axis & Focus and directrix method
 - Cycloid- by generating circle rolling on a straight line
 - Involute of a triangle, circle & pentagon
 - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

Unit 4 Orthographic projection

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
 - (i) Parallel to both Principal planes
 - (ii) Parallel to one and Perpendicular to other Principal plane.
 - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids
Cylinder, cone, cube.

Right regular solids such as
 - (i) Prism: Triangular & Square
 - (ii) Pyramid: Square & Pentagonal.
 - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.

- Conversion of simple pictorial views into orthographic views.
- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

Unit 5 Section of solids

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

Unit 6 Development of lateral surfaces

- Concept and importance of surface development in the engineering field.
Methods of development of surfaces-Radial & Parallel line method.
Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

Unit 7 Isometric Views

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No.	Unit	Teaching Hours / Semester
1	Introduction	1
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	13
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	Total	32

5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involute, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants. Drawing of projections of lines in following positions (i) Parallel to both Principal planes (ii) Parallel to one and Perpendicular to other Principal plane. (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube. Right regular solids such as Prism: Triangular & Square, Pyramid: Square & Pentagonal, when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views. (atleast 2 problems each in 1 st angle and 3 rd angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)	8

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9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids- Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher, Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher, Anand

GN 205 ENGINEERING MATERIALS

1. RATIONALE:-

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
G-205 Engineering Materials	4	-	-	4	75	25	-	-	100

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. COURSE CONTENTS

Unit 1 Introduction to Engineering Materials

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

Unit 2 Ferrous & Non-Ferrous Metals & its Alloys

➤ **Ferrous alloys.**

- Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
- Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
- Alloy steels.
 - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
 - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
- Tool steel – composition, HSS, High carbon steel, properties & uses.

➤ **Non-ferrous Metals & alloys**

- Aluminium – Properties & uses.
- Aluminium alloys – constituents of alloy & their effect on properties of metal
- Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
- Copper – Properties & uses.
- Copper alloys – Constituents of alloy & their effect on properties of metal.
- Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
- Properties & uses of lead & its alloys.

Unit 3 Non – Metallic materials

- Refractory
 - Desirable properties.
 - Difference between acid, basic & neutral refractories.
 - Properties & uses of Fire clay refractory, silica refractory.
 - Plastic
 - Classification table only.
 - Properties & uses of Thermosetting & Thermoplastic.
 - Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
 - Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
 - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.
 - Introduction to composite materials. Classification diagram only.

Unit 4 Conductor, Semi Conductor, Insulating and Magnetic Materials.

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
 - High conductivity materials
 - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
 - Their properties as conducting materials and applications.
 - High resistivity materials
 - hichrome, constantan, manganin
 - Their applications
- Insulating materials
 - Introduction
 - Characteristics of Good Insulating materials
 - Solid Insulating materials
 - Wood, paper, rubber, mica, glass tibre, porcelain, varnish, PVC, Resins.
 - Their characteristics as insulating materials and applications.
 - Liquid insulating materials
 - Mineral oil, its properties as insulating material and applications.
 - Gaseous insulating materials like air, Nitrogen, Sulphur hexafloride & their applications.
- Semiconductor Materials.
 - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.
 - Classification as:
 - * Dia Magnetic
 - * Para Magnetic
 - * Ferromagnetic
 - * Non magnetic

List of these materials and their applications.

Unit 5 Construction Materials

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
 - Lime – Sources. Properties, uses.
 - Clay – Different building products from clay like tiles, pipes etc.
 - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
 - Sand – Sources: rivers, crushed aggregates, characteristics uses.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	04	09
2	Ferrous & Non-Ferrous Metals & its Alloys	16	18
3	Non – Metallic materials	12	12
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	16	18
5	Construction Materials	16	18
		64	75

Semester: III

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	T M	PR/OR	T W	
EE301	Circuit Theory	4	1	2	7	75	25		25	125
EE302	Electrical Machines _I	4	1	2	7	75	25		25	125
CS 309	Digital Electronics	3		2	5	75	25	50(P)	25	175
EE303	Electrical Measurements & Insrtuments	4		2	6	75	25	50	25	175
CS305	Computer aided Drafting			4	4			50	50	100
EE304	Power Generation, Transmission & Distrubition	3			3	75	25			100
Total		18	2	12	32	375	100	200	150	800

EE 301 CIRCUIT THEORY

1. RATIONALE

This course is intended to enable the student understand the concepts and principles of the electrical circuits and how to analyze them. It will also enable the students to understand the concept of resonance and various properties of resonant circuit

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EE 301 Circuit Theory	4	1	2	7	75	25	25	--	125

Minimum passing % : **Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 :D.C.NETWORK THEOREMS

Definition: Circuit parameters, Linear, non-linear, bilateral , unilateral , electric network, passive and active network, node, branch, loop/mesh.

Ideal and practical voltage and current sources.

Kirchhoff's current law, Kirchhoff's voltage law

Mesh analysis/nodal analysis with current and voltage sources.

Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, star to delta and delta to star conversions, source transformation

Unit 2 – SINGLE PHASE A.C. CIRCUITS

AC through pure resistance, pure inductance, pure capacitance.

Concept of reactance, impedance and impedance triangle, power triangle, voltage triangle, definition of power factor, active ,reactive, apparent power.

Analysis of single phase circuits – RL, RC and RLC (vector method analysis.)

Analysis of parallel RLC circuits – (Only admittance method, application of admittance method)

Unit 3 - RESONANCE:

Concept of resonance in circuit,

Definition of resonant frequency, Q factor, bandwidth. Calculation of resonant frequency, Q factor (selectivity) and bandwidth for series & parallel resonant circuit (no derivation).

Unit 4 - POLY PHASE CIRCUIT

Generation of poly phase voltage, phase sequence, interconnection of three phases (star & delta connection),

Relationship between phase and line current and line & phase voltage for star and delta connected balanced loads. Calculation of active , reactive & apparent power.

Unit 5 - SYMMETRICAL COMPONENTS

Definition of unbalanced system (Positive , negative & zero sequence component), only analytical method of evaluation of components.

Unit 6 - AC BRIDGES

General equation for bridge balance

Maxwell's inductance bridge, Hays bridge, Desauty's bridge, Wein's bridge.

Unit 7- Transients (No analysis, no numerical)

Definition of transients and types of transients.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	DC Network Theorems	12	18
2	Single Phase A.C. Circuits	16	18

Directorate of Technical Education, Goa State

3	Resonance	9	12
4	Poly Phase Circuit	12	12
5	Symmetrical Components	8	6
6	Ac Bridges	5	6
7	Transients	2	3
	TOTAL	64	75

5. List of Experiments : Any 8

1. Verification of Kirchoff's law in d.c. circuit.
2. Verification of Thevenin's Theorem in d.c. circuit.
3. Verification of Superposition theorem.
4. Measurement of voltage current and d.c. resistance in a R-L circuit and determination of resistance and inductance.
5. Study of effect of addition of capacitance in R-L circuit on current, & p.f.
6. Study of effect on line current (a.c.) in star/delta (connection of 3 single phase loads.)
7. Determination of resistance & inductance of a given R-L load by measurement of voltage, current and p.f.
8. Connection and measurement of current drawn, power consumed and voltage drop in each element of a 2 branch parallel circuit.
9. Design assembly and testing of a series resonant circuit.
10. To plot charging & discharging curve of R-C circuit.
11. Analysis of bridges (Measurement of L C R & Q using bridges) .

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Soni, Gupta	A Course in Electrical Circuit	Dhanpat Rai & Sons
2	B.L.Theraja	Electrical Technology Vol I	S Chand
3	Vicent Deltero	Principles of Electrical Engg	Prentice Hall of India
4		Electric circuits	Schaum series

EE 302 ELECTRICAL MACHINES-I

1. RATIONALE

This subject enables the student to understand the working principle, construction, performance, control and applications of electrical machines such as DC Generator, DC motor & Transformers. The students get familiarized with the various constructional parts, classification, operation, fault finding & trouble shooting of these machines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EE 302 Electrical Machines-I	4	1	2	7	75	25	25	--	125

Minimum passing % : **Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : CONSTRUCTION OF DC MACHINE

Working of a simple loop DC machine, constructional details of various parts of a DC machine, material used & their functions, concept of lap & wave winding (no numerical & no layout).

UNIT 2 – DC GENERATOR: (No numerical)

Expression for generated EMF (no derivation) & factors on which it depends, classification of DC generators w.r.t i) excitation system, ii) connection of field & armature winding, voltage & power equations of these various types, process of voltage build up in DC Shunt generator, losses and types of efficiencies. DC welding generator (working & constructional features). Conditions & necessity of parallel operation of DC generators.

UNIT 3 - DC MOTORS (no numerical):

Principle of operation & working, concept of back emf & its importance, development of torque and types of torques in a motor, classification of DC motors based on connection of field & armature winding and their voltage & power equations, speed equation, methods of speed control and their comparison, characteristics of DC shunt, series & compound motors: speed v/s armature current, torque v/s armature current & speed v/s torque, applications of the various types of DC motors, starting of DC motors – Necessity of a starter, three point & four point starters,

UNIT 4 - WORKING & CONSTRUCTION OF TRANSFORMERS:

Definition and working principle of a transformer, concept of ideal & practical transformer, EMF equation of a transformer, transformation ratio- voltage ratio, current ratio & turns ratio, terms related to transformer: primary & secondary, H.V & L.V, step up & step down, concept of leakage flux & its effects on the working of transformer, construction –main parts and accessories of a transformer and their functions, concept & comparison of core type & shell type transformers, various types of insulation used in transformers- inter turn, winding to winding, winding to core, cooling system- need of cooling & different types of cooling systems, concept & types of tap changer – ON load & OFF load tap changer.

UNIT 5 - OPERATION, EQUIVALENT CIRCUIT & PERFORMANCE OF TRANSFORMERS:

Operation - No load and on load operation of a transformer with phasor diagram & effect of leakage reactance and winding resistance.

Equivalent circuit and transfer of its parameters referred to either side. O.C & S.C test.

Performance – concept & significance of voltage regulation, its expression (up & down), calculation & condition for minimum regulation, losses and efficiency of a transformer, condition for maximum efficiency, effects of voltage & frequency variation and failure of cooling system on the performance of a transformer, salient features of a power & distribution transformer (three phase).

UNIT 6 - PARALLEL OPERATION OF TRANSFORMERS: (No Numerical)

Conditions to be satisfied for parallel operation of transformers (single & three phase) and their connections.

UNIT 7- AUTOTRANSFORMERS & SPECIAL TRANSFORMERS (no numerical):

Construction & principle of operation of an autotransformer, its advantages & disadvantages over two winding transformer, special transformers-welding transformer, open delta connected transformer, furnace & high frequency transformer (constructional features).

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Construction Of Dc Machine	5	6
2	Dc Generator	09	10
3	Dc Motors	13	12
4	Working & Construction Of Transformers	12	15
5	Operation, Equivalent Circuit & Performance Of Transformers	15	16
6	Parallel Operation Of Transformers	4	6
7	Autotransformers & Special Transformers	6	10
TOTAL		64	75

5. List of Experiments : Any 8

1. To plot the O.C characteristics of a DC shunt generator and find the value of critical field resistance.
2. To plot the external characteristics of a DC shunt generator.
3. Speed control of a DC shunt motor above & below normal speed.
4. To plot the speed torque characteristics of a DC shunt generator.
5. Starting a DC shunt motor using a starter and reversal of direction of rotation.
6. To perform Swinburne's test on a Dc shunt motor to determine the various losses and calculate efficiency as a Dc motor & generator.

7. Insulation resistance, polarity, phasing out & ratio test on a three phase transformer.
8. O.C & S.C test on a three phase transformer and calculation of equivalent circuit parameters.
9. Parallel operation of two single phase transformers and observation of the load sharing.
10. To study direct load test on a three phase transformer and measurement of its voltage regulation.
11. To perform back to back test on a single phase transformer to determine losses and calculate efficiency and regulation.
12. To study a welding transformer w.r.t:- i) construction of core, ii) placement of windings, iii) current controller & iv) cooling system.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	BHEL	Transformers	Tata Mcgraw
2	S.K. Bhattacharya	Electrical machinery	Tata Mcgraw
3	J.B.Gupta.	Theory & performance of Electrical Machines	S. K. Kataria & sons
4	B.L.Theraja.	Electrical Technology (Vol II)	S Chand
5	P.S. Bhimbra.	Elementary theory of electrical machines	Khanna Publishers

CS 309 DIGITAL ELECTRONICS

1. RATIONALE:

This course includes detailed study of digital circuits such as adders, subtractors, flip flops, counters, registers and memories. This course will enable the students to understand the structure of digital computers, peripheral and other digital devices.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS309 DIGITAL ELECTRONICS	L	T	P	C	TH	TM	TW	PR/OR	175
	3	-	2	5	75	25	25	50(P)	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS:

Unit-I Number Systems

(7 hrs) (12 marks)

Digital and Analog Signals- Decimal, binary, hexadecimal number system, conversion from one system to another, BCD code, ASCII code, gray code.
2's complement binary addition and subtraction.

Unit-II Combinational circuits.

(14hrs) (21 marks)

Symbol, truth table of basic gates (OR, NOR, AND, NOT, XOR, XNOR)

Laws of Boolean algebra and simplification of Boolean expressions

Demorgans and Duality theorem

K-map techniques (upto 4 variables)

Implementation of NOT,OR and AND gates using Universal gates (NAND, NOR)

Half adder, Full adder, Half subtractor , Full subtractor.

4-bit parallel binary adder: block diagram and operation.

Block diagram and implementation using basic gates: Multiplexer (4 to 1), Demultiplexer (1 to 4),

Encoder (4 to 2), Decoder (2 to 4).

BCD to 7 segment decoder driver (common cathode).

Unit-III Flip Flop.

(8 hrs) (12 marks)

Symbol, truth table, operation and timing diagrams of RS F/F & clocked RS F/F (using NAND gates), D F/F JK F/F, JK master slave F/F (no timing diagram), T F/F.

Unit-IV Registers & Counters.

(8 hrs) (21 marks)

4 bit shift Register- function and logic block diagram, timing diagrams with negative edge triggered D F/F (Serial in-parallel out, Serial in-serial out, parallel in-parallel out register, parallel in serial out shift register), concept of shift right shift left, Ring counter.

Counters (no design). – Asynchronous/ Synchronous 4 bit up counter & Asynchronous/ synchronous 4 bit Down Counter, decade (mod 10) counter (synchronous type) (timing diagrams with negative edge triggered)

Unit V-ADC & DAC

(7 hrs) (9 marks)

Types of ADC & DAC (no description)

Working of binary ladder DAC.

Successive approximation ADC (only).

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Number Systems	7	12
2	Combinational Circuits	14	21
3	Flip flops	8	12
4	Registers and Counters	8	21
5	ADC and DAC	7	9

5. UGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Verification of logic gates and demorgans theorem.
2	NAND as universal gate
3	NOR as universal gate
4	Half adder and full adder
5	Half subtractor and full subtractor
6	MUX & D-MUX
7	Seven segment decoder common anode & common cathode
8	RS and JK F/F
9	Assemble and test shift register using IC 7495
10	Assemble and test decade counter (any one type)
11	Assemble and test DAC

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	Malvino and Leach	Digital principal and applications	Latest
2	R.P. Jain	Modern Digital Electronics	Latest
3	Bartee	Digital Computer Fundamentals	Latest

EE 303 ELECTRICAL MEASUREMENTS & INSTRUMENTS

1. RATIONALE

This subject enables the student to understand the classification , essential constructional features of electrical measuring instruments as well as their working principles. It will also enable the students to select & connect the instruments in correct manner during measurements. The student will also learn various methods for extension of the ranges of measuring instruments.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE 303	L	T	P	C	TH	TM	TW	PR/OR	175
Electrical Measurements & Instruments	4	-	2	6	75	25	25	50(P)	

Minimum passing % : **Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : FUNDAMENTALS OF MEASUREMENTS:

Need of Measurement & Significance of measurement

Classification of Instruments

Absolute & secondary instruments

Indicating, recording & integrating instruments

Based on permissible limits of errors

Qualities of instrument like sensitivity, accuracy, precision, reliability, reproducibility, drift, static error, true value, resolution.

Errors: Gross error, Systematic error & Random errors

UNIT 2 – PRINCIPLES OF MEASUREMENT:

Various effects of electric current and their use in measurement

Essentials of Indicating instruments: Deflecting torque , Control torque , Damping torque.

Various methods of providing control torque & damping torque.

UNIT 3 - AMMETER & VOLTMETER (NO NUMERICAL)

Construction & Principle of operation of PMMC instrument. Errors in PMMC type instruments.

Construction & Principle of operation of moving iron type (attraction & repulsion type) instrument. Errors in moving iron type instruments

Rectifier type instrument, its construction & advantages.

Loading effect of Voltmeter.

UNIT 4 - WATTMETER

Dynamometer type wattmeter: Construction & principle of operation

Measurement of power : Three phase ,3 wire circuit by two wattmeter method, Phasor diagram, 3 phase, 4 wire circuits by 3 wattmeter method, Variation of wattmeter readings with load power factor.

Errors and compensation.

UNIT 5 - ENERGYSMETER

Induction type energy meter: Construction & principle of operation.(single & three phase)

Concept & block diagram of Electronics energy meter.

UNIT 6 - RESISTANCE MEASUREMENTS :

Voltmeter Ammeter method

Wheatstones bridge method

Kelvin's Bridge, Kelvin's Double Bridge

Series type & shunt type ohm meter

UNIT 7- EXTENSION OF RANGE

Using Shunt & Multiplier

Using CT & PT for ammeter, Voltmeter , Wattmeter, Energysmeter

Extension of range of wattmeters for measurement of power in 3 phase, 3 wire circuit

Extension of range of single phase & three phase energy meter

UNIT 8- OTHER INSTRUMENTS:

Operation ,connection & applications of

1. Power Factor meter: electro-dynamometer (single phase)
2. Frequency meter: Vibrating reed type
3. Earth Tester
4. Phase sequence indicator
5. Megger
6. Trivector meter

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Fundamentals Of Measurements	4	6
2	Principles Of Measurement	6	9
3	Ammeter & Voltmeter	10	12
4	Wattmeter	12	12
5	Energymeter	6	9
6	Resistance Measurements	6	9
7	Extention Of Range	10	9
8	Other Instruments	10	9
TOTAL		64	75

5. List of Experiments: Any 8-10

1. Measurement of power by 3 ammeter method
2. Measurement of power by 3 voltmeter method
3. Measurement of resistance by Kelvin's Double Bridge
4. Measurement of power in 3 phase 3 wire circuit by 2 wattmeter method

5. Measurement of power in 3 phase 3 wire circuit by 1 wattmeter method
6. Measurement of reactive power in 3 phase , 3 wire circuit by 1 wattmeter method
7. Measurement of energy by energy meter
8. Extention of range of wattmeters for measurement of power in 3 phase ,3 wire circuit by using CT & PT
9. Measurement of power factor using power factor meter.
10. Connection & measurent of Voltage , current , power& energy using digital meters
11. Connection & use of power analyzer
12. Connection & use of demand controller
13. Study of symbols

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	A. K. Sawhney	A course in Electrical & Electronic Measurements & Instrumentation	Dhanpat Rai & sons
2	S.C. Bhargava	Electrical Measuring Instruments & Measurements	B.S.Publication
3	Vijay Singh	Fundamentals of Electrical & Electronic Measurements	New Age international(p) Ltd
4	N.V. Suryanarayana	Electrical Measurements & Measuring Instruments	Tata Mc Graw Hill
5			

EE 304 POWER GENERATION ,TRANSMISSION & DISTRIBUTION

1. RATIONALE

This subject enables the student to understand different sources of energy and how electricity is generated from these sources ,including non conventional sources of energy. They will also understand how energy is transmitted and distributed to the loads and the material / components used in transmission & distribution lines . In this course they will study different types of domestic wiring and earthing.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE 304	L	T	P	C	TH	TM	TW	PR/OR	100
Power generation , Transmission & Distribution	3	-	-	3	75	25			

Minimum passing % :**Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : GENERATION

Terms related to generation such as load curve, demand factor, diversity factor, load factor, utilization factor.

Concept of Base load & Peak load power plant

Grid System , its merits & demerits

Main sources of energy for bulk power generation(Thermal,

Hydro & nuclear). Principle of generation using these sources & plant layout.

Non conventional energy sources: Types(solar, wind & tidal), availability & economic feasibility

Advantages & disadvantages of Diesel power plant

Stand by diesel generator sets; its main components & their functions

UNIT 2 – TRANSMISSION:

Components of Transmission lines, types of supports (poles :MS rail & RCC, towers), classification of towers

Resistance, inductance & capacitance of transmission lines . Classification of transmission lines as Short, Medium & Long lines.(No derivation & no numerical).

Concept of transposition of conductors

Conductor: AAC , ACSR, All aluminum alloy conductor, bundled conductor, general electrical & mechanical properties.

Insulators: Pin type, suspension type, post type & tension type, stay insulator. Material used. comparison between pin type & suspension insulators. Causes of failure of insulators. Voltage distribution & string efficiency. General Specification.

HV, EHV & HVDC transmission system, their main components. Advantages & Disadvantages of each system.

Concept of Skin effect

Corona: its formation, advantages & disadvantages. Methods of its reduction.

Sag & its importance(No numerical)

UNIT 3 – DISTRIBUTION SYSTEM

Classification of distribution system w.r.t voltage & number of wires

DC 2 wire, AC 2 wire (single phase), AC 3 wire & AC 4 wire system. Their comparison

Concept of feeder, distributor & service mains

Types of distributor: Radial ,ring & interconnected System

System voltage, permissible voltage drops in various parts of distribution system for urban, semi urban & rural areas.

UNIT 4 – DOMESTIC WIRING

PVC casing & capping, conduit (PVC , metallic & concealed) & Cleat wiring. Material use for each wiring & their comparative Study. I.E Rules and standard practices relevant to light & fan , power wiring

Planning & layout of domestic installation including Godown & staircase wiring

Estimation of quantity of material required for given domestic installation

UNIT 5 - EARTHING

Importance of earthing, I.E rules & standard earthing practices.

Methods of earthing: Pipe & plate

Factors affecting earth resistance, methods of reducing earth resistance.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Generation	10	15
2	Transmission	18	24
3	Distribution System	9	15
4	Domestic Wiring	7	12
5	Earthing	4	9
TOTAL		48	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	V.K.Mehta	Principles of Power System	S. Chand
2	J.B.Gupta	A course in Electrical power	S.K Kataria & sons
3	Dr S.L. Uppal	Electrical Power	Khanna Publishers
4	Raina, Anand & Singhal	Transmission & Distribution of Electrical Energy	
5	Arora B D	Electrical Wiring Estimation & Costing	R.B.Publications
6	Raina & Bhattacharya	Electrical Design Estimating & Costing	New Age International Publishers
7.	J.B.Gupta	Electrical Installation Estimation & costing	S.K Kataria & sons

(CS 305) COMPUTER AIDED DRAFTING

1. RATIONALE:

The market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawings as required using various CAD software.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks	Practical Marks			
CS305 Computer Aided Drafting	L	T	P	C	TH	TM	TW	PR/OR	100
			4	4	-	-	50	50(P)	

3. COURSE CONTENTS:

1.	Intr
roduction and CAD Preliminaries.	2
hours	
•	Co
omputer aided drafting concept.	
•	Har
oftware and various CAD software available.	
•	Co
omponents of a CAD software window such as Titlebar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area, UCS icon.	
•	File
eatures: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.	

<ul style="list-style-type: none">• ing up new drawing : Units, Limits, Grid, Snap.	Sett
<ul style="list-style-type: none">• doing and Redoing action.	Un

<p>2.</p> <p>wing using CAD software: hours</p> <ul style="list-style-type: none"> • 	<p style="text-align: right;">Dra</p> <p style="text-align: right;">10</p> <p style="text-align: right;">Dra</p> <p>wing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.</p> <p style="text-align: right;">Met</p> <p>hods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.</p> <p style="text-align: right;">Usi</p> <p>ng Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.</p>
<p>3.</p> <p>t/modify features and viewing drawings. hours</p> <ul style="list-style-type: none"> • • • 	<p style="text-align: right;">Edi</p> <p style="text-align: right;">10</p> <p style="text-align: right;">Obj</p> <p>ect Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.</p> <p style="text-align: right;">Edi</p> <p>ting Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.</p> <p style="text-align: right;">Mo</p> <p>dify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet.</p>
<p>4.</p> <p>anising Drawing: hours</p> <ul style="list-style-type: none"> • 	<p style="text-align: right;">Org</p> <p style="text-align: right;">6</p> <p style="text-align: right;">Co</p> <p>ncepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like</p>

colour, line type, line weight.

- Co

concept of blocks : Creating, inserting, redefining and exploding blocks.

- Co

concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.

- Pol

polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.

<p>5.</p> <p>Dimensioning and Tolerancing</p> <p>hours</p> <ul style="list-style-type: none"> • Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader. • Dimension scale variable, adding geometric tolerances • Dimensioning dimensions • Dimensioning text: Single line text, Multiline text. • Dimensioning text styles: selecting font, size, arrows, alignment, etc. 	<p>Di</p> <p>8</p> <p>Di</p> <p>Di</p> <p>Edi</p> <p>Sin</p> <p>Tex</p>
<p>6.</p> <p>3D features</p> <p>hours</p> <ul style="list-style-type: none"> • Dimensioning with hand rule/local global co-ordinate system. • Specifying 3D coordinates • Dimensioning using UCS • Dimensioning user coordinate system using UCS command with its options. • Dimensioning in 3D 	<p>3D-</p> <p>2</p> <p>Rig</p> <p>Usi</p> <p>Def</p> <p>Vie</p>
<p>7.</p> <p>Isometric Drawing:</p> <p>hours</p> <ul style="list-style-type: none"> • Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings 	<p>Iso</p> <p>10</p>

<p>8.</p> <p> d Modeling</p> <p> hours</p> <ul style="list-style-type: none"> • • • • 	<p> Concept of solid modeling</p> <p> Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.</p> <p> Constructing a region, creating an extruded solid, creating a revolved solid.</p> <p> Creating composite solids using union, intersection and interface commands.</p>	<p>Soli</p> <p>12</p> <p>Co</p> <p>Cre</p> <p>Co</p> <p>Cre</p>
<p>9.</p> <p> Model space, Paper space, viewports and layouts</p> <p> hours</p> <ul style="list-style-type: none"> • • • 	<p> Concept of model space and paper space.</p> <p> Creating viewports in model space and creating floating viewport in paper space.</p> <p> Switching from model space to paper space and vice versa.</p>	<p>Mo</p> <p>2</p> <p>Co</p> <p>Cre</p> <p>Shi</p>
<p>10.</p> <p> Printing/ Plotting drawing.</p> <p> hours</p> <ul style="list-style-type: none"> • • 	<p> Standard sizes of sheet.</p> <p> Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.</p>	<p>Pri</p> <p>2</p> <p>Sta</p>

4. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.
6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
 - a) Civil Engineering. & Architectural Engineering: Plan, elevation and section of a single story residential building.
 - b) Electrical & Electronics Engineering.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
 - c) Mechanical Engineering.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
 - d) Shipbuilding Engineering.: Body plan of a ship.
 - e) Mining Engineering.: Plan and section of an opencast mine benches, Plan and section of an underground mine.
 - f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

5. LEARNING RESOURCES

1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
2. Mastering AutoCAD – George Omura- BPB Publication.
3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.

4. AutoCAD 2000 – Devid Frey- BPB Publication.
5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
6. Using AutoCAD 2000 – Ron House – Prentice Hall.
7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
8. CATIA V6 Essentials by Jones & Bartlett learning.
9. Inside Catia by Paul Carman, Paul Tigwell.
10. CATIA Tutorials by Nader G. Zamani.

Semester: IV

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
EE401	Electrical Machines-II	4		2	6	75	25	50(P)	25	175
EE402	Applied & Integrated Electronics	4		2	6	75	25		25	125
EE403	Utilisaton of Electrical Energy	4			4	75	25			100
EN404	Electronic Instrumentation	3		2	5	75	25		25	125
EE404	Electrical Workshop Practice			2	2			50(O)	25	75
CS307	Elements of Mechanical Engg	3		1	4	75	25		25	125
CS311	Elements of Civil Engg .	3		2	5	75	25		25	125
Total		21		11	32	375	125	150	150	850

(EE401) ELECTRICAL MACHINES-II

1. RATIONALE

This subject enables the student to understand the working principle, construction, performance & characteristics, control and applications of various AC electrical machines such as Induction motor (single phase & three phase), alternator, synchronous motor and other AC motors. The students would get acquainted with the knowledge regarding analyzing the various parameters of these machines and also get familiarized with the various starting methods & starters used for starting of these machines along with their control circuits

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EE 401 Electrical Machines-II	4		2	6	75	25	25	50(P)	175

Minimum passing % : **Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : CONSTRUCTION OF THREE PHASE INDUCTION MOTOR

Fundamental principles of rotating machines:- Production of rotating magnetic flux in a 3 phase winding, working principle of 3 phase Induction motor, constructional details and its types:- slip ring and squirrel cage (single & double cage), concept of rotor slip, rotor frequency, rotor emf, rotor current under standstill and running condition.

UNIT 2 – PERFORMANCE OF INDUCTION MOTOR

Development of phasor diagram at standstill and at full load conditions. Equivalent circuit diagram . Power flow and calculation of efficiency in induction motor, pull up & pull out torque. Effects of variations of supply voltage, frequency on torque and speed. Torque-slip characteristics of induction motor . Relationship between starting torque and full load torque, starting torque and maximum torque. Terminal marking for three phase induction motor.

UNIT 3 – INDUCTION MOTOR STARTERS (NO NUMERICALS)

Methods of starting squirrel cage and slip ring induction motors, types & need of direct on line starter, star/delta starter, auto transformer starter for Squirrel cage induction motor & rotor resistance starters for slip ring induction motor. Concept of soft starter and its advantages. Power & control circuit, working of DOL & fully automatic Star Delta starter.

UNIT 4 – SINGLE PHASE INDUCTION MOTORS

Construction, principle of operation, rotating field theory, torque-speed characteristics. Characteristics of single phase induction motor based on methods of starting - resistance split phase (capacitor start , capacitor start and run, capacitor start and capacitor run, shaded pole).

UNIT 5 – COSTRUCTION OF ALTERNATOR

Classification, construction, components and functions of salient pole & cylindrical pole type.

Advantages of stationary armature & rotating magnetic field .Frequency of induced emf and factors on which it depends, emf equation for a full pitched coil, fractional pitched coil. Coil span factor and coil distribution factor (no derivation), effects of these factors on generated emf. Hunting and use of damper windings.

UNIT 6 - OPERATION OF ALTERNATORS:

Operation of alternator under no load & on load

Armature reaction in a three phase alternator and effects of load power factor on it. Operating parameters –armature resistance, leakage reactance, synchronous reactance and synchronous impedance. Phasor diagram of alternator under no load and on load condition. Regulation of alternator and its calculation by synchronous impedance method and by direct loading. Open circuit and short circuit test and calculation of synchronous impedance, operating characteristics of alternator, their ratings and specifications for procurement.

UNIT 7- PARALLEL OPERATION OF ALTERNATORS (no numericlas)

Necessity & desirable conditions for parallel operation of alternators, methods of synchronizing of alternators (lamp method and synchroscope method), effects of change of excitation on power factor, effects of change in the input power to one of the alternators.

UNIT8 : SYNCHRONOUS MOTOR

Principles of operation and special features of synchronous motor. Definition of load angle .Torque and power equations of a synchronous motor, variation of currents and power factor under variable excitation & constant load . Concept of synchronous condenser.

UNIT 9 : SINGLE PHASE SPECIAL MOTORS

Construction, principle of operation & applications of Reluctance motor, hysteresis motor, universal motor, repulsion motor.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Construction Of Three Phase Induction Motor	4	6
2	Performance Of Induction Motor	14	15
3	Induction Motor Starters	6	9
4	Single Phase Induction Motors	6	9
5	Costruction Of Alternator	6	6
6	Operation Of Alternators	10	12
7	Parallel Operation Of Alternators	8	6
8	Synchronous Motor	6	6
9	Single Phase Special Motors	4	6
TOTAL		64	75

5. List of Experiments : Any 8

- 1) To perform no load & blocked rotor test on a 3 phase induction motor and:-
 - a) Determine its equivalent circuit parameters, total losses & efficiency, b) plot the circle diagram to determine the total losses & efficiency.
- 2) To perform load test on a 3 phase induction motor and determine efficiency and variation of speed, power factor with the load.
- 3) Identification of parts, functions (operational & protectional) in the following starters and their specifications:- DOL , autotransformer, star delta, rotor rheostat starters.
- 4) Starting & reversal of direction of rotation of a 3 phase & 1 phase induction motor.

Directorate of Technical Education, Goa State

- 5) To perform no load & blocked rotor test on a 1 phase induction motor and determine its efficiency.
- 6) To perform O.C & S.C test on an alternator and determine its synchronous impedance and voltage regulation.
- 7) To determine the excitation required to maintain constant voltage in an alternator under varying voltages
- 8) To plot “V curves” for a synchronous motor.
- 9) To perform the parallel operation of alternators .
- 10) To study the performance of special motors w.r.t current drawn, power consumed, sparking at the brushes and noise level.
- 11) Field visit.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	S.K. Bhattacharya	Electrical machinery	Tata Mcgraw
2	J.B.Gupta.	Thoery & performance of Electrical Machines	S. K. Kataria & sons
3	B.L.Theraja.	Electrical Technology (Vol II)	S Chand
4	P.S. Bhimbra.	Elementary theory of electrical machines	Khanna Publishers

(EE402) APPLIED AND INTEGRATED ELECTRONICS

1. RATIONALE:

This course includes detailed study of electronic circuits such as regulators, amplifiers, oscillators, multivibrators and will enable students to understand the basics of integrated electronics. An understanding of all these will provide a good platform to enter into more complex and specialized fields of Electrical and Electronics engineering

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE 402	L	T	P	C	TH	TM	TW	PR/OR	125
APPLIED & INTEGRATED ELECTRONICS	4	-	2	6	75	25	25	-----	

3. DETAILED COURSE CONTENTS:

<p>UNIT1 ZENER DIODE</p> <p style="text-align: center;">Concept, characteristics and operation of zener diode as voltage regulator.</p>
<p>UNIT2 TRANSISTORS</p> <p>BJT – Basic construction, types-NPN and PNP. Basic configuration- CB,CE,CC. Transistor input and output characteristics in all configurations. Transistor action , current relationship, α, β concepts and their relation. Biasing of transistor- concept and need of biasing, Q point, DC and AC load line, concept of active,saturation and cut off region. Biasing techniques- fixed bias, emitter stabilized bias and voltage divider bias(circuit, analysis and expressions.) Operation of transistor as a switch and amplifier.</p>
<p>UNIT 3 AMPLIFIERS</p> <p>Concept of Z_i, Z_o, A_i and A_v. Small signal Amplifiers- Single stage CE amplifier(circuit, working and frequency response). Two stage CE amplifier (circuit, working and frequency response), Methods of coupling-RC and direct coupling(No Derivation). Power Amplifier(No analysis)- concept of power amplifiers, classification- Class A,B,C and push-pull amplifier(circuit working and applications of all types)</p>

**UNIT 4 OSCILLATORS & MULTIVIBRATORS
(NO ANALYSIS)**

Concept of positive feedback, Barkhausen Criterion.
 RC oscillator- Working of RC Phase Shift Oscillator. Expression for frequency.
 LC oscillator- Concept of tank circuit, Working of Crystal Oscillator.
 Expression for frequency.
 Multivibrators- Monostable, Astable, Bistable(Circuit operation and waveforms.)Schmitt Trigger.

**UNIT 5 OPERATIONAL APLIFIERS
(No Derivations)**

Concept of differential amplifier, different modes of operation-DIBO,DIUO.
 Block diagram and working of Op Amp- Schematic diagram, Equivalent circuit, symbol and pin configuration of IC741.
 Op Amp parameters- Input offset voltage, output offset voltage, input offset current, input bias current,CMRR,slew rate(only definitions.)
 Characteristics of ideal and practical Op Amps,Mode sof operation of Op Amp- inverting and non inverting.

UNIT 6 APPLICATIONS OF OPAMP

Op Amp as summer, subtractor.
 Op Amp as Zero crossing detector and Schmitt Trigger(no derivation)
 Op amp as integrator and differentiator.
 Introduction to IC555 Block diagram, Pin configuration and application.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Zener Diode	2	4
2	Transistors	12	14
3	Amplifiers	14	15
4	Oscillators & Multivibrators	10	12
5	Operational Amplifiers	14	15
6	Applications Of Opamp	12	15

Unit No.	Topic	Teaching Hours/ Semester	MARKS
TOTAL		64	75

5. LIST OF EXPERIMENTS : (Any eight)

1. To verify working of Zener Diode as voltage regulator for change in supply voltage and load.
2. Plot Input and output characteristics of CE amplifier.
3. To verify Q point parameters, saturation and cut off points for CE configuration using fixed bias circuit.
4. Assembly and Working of RC phase Oscillator and to verify oscillation frequency.
5. To plot the frequency response of single stage RC coupled amplifiers.
6. Assembly and Working of any multivibrator circuit and to verify oscillation frequency.
7. Assembly and Working of Schmitt Trigger (using BJT or IC741).
8. To verify DC parameters of IC741.
9. To verify working of Op Amp in inverting and non inverting configuration.
10. To verify working of Op Amp as adder and subtractor .
11. To verify working of Op Amp as integrator and differentiator.
12. To verify working of Op Amp as zero crossing detector.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	J. B. Gupta	Electronic Devices and Circuits	Katsons
2	Ramakant Gayakwad	Linear integrated Circuits	Prentice-Hall Of India
3	Robert Boylestead	Electronic Devices and Circuits	Prentice-Hall Of India
4	Bhargava	Basic electronics	Tata McGraw - Hill Education

(EE403) UTILISATION OF ELECTRICAL ENERGY

1. RATIONALE

The course will enable the learner to understand various uses of electrical energy in domestic and industrial applications. The learner will understand the concept of electrical heating, welding & electrical traction, illumination & some controllers used in them.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EE 403 Utilisation of Electrical Energy	4	-	-	4	75	25	--	--	100

Minimum passing % : **Theory** 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : INTRODUCTION TO HEATING

Modes of heat transfer: Conduction, Convection & Radiation, Formula for heat transfer by Conduction, Convection & Radiation (no derivation).

Advantages of electric heating.

Methods of electric heating.

UNIT 2 – RESISTANCE HEATING :

Resistance heating

Direct & indirect resistance heating

Infrared heating & its applications

Types of Heating Elements: Materials used, desirable properties

Design of Heating elements (no derivation)

Heat control Methods: selector switch, tapped transformer

Control circuit for typical simple resistance oven

UNIT 3 – OTHER HEATING METHODS

Induction heating

Induction furnace: principle of operation, basic construction & applications

High frequency eddy current heating

Dielectric Heating; Principle of operation & applications

Arc Furnace: basic principle, operation , types

UNIT 4 – ARC WELDING

Principle of arc welding

Arc formation & its control

Phenomenon of arc blow & methods of reducing it

Requirements of arc welding source : DC & AC

Current controllers for welding source

Comparison of AC & DC welding

UNIT 5 – RESISTANCE WELDING

Principle of resistance welding

Types: 1. Butt welding, 2. Flash welding, 3. Spot welding, 4. Seam Welding ,
5. Projection welding

UNIT 6- TRACTION

Systems of electric Traction

Speed time curve for main line ,suburban & urban trains (no numerical)

Traction motors: requirement of traction motors, AC & DC motors used

Starting & speed control :series parallel method

Transition methods: Shunt , bridge.

Traction current collecting equipment

Catenary construction

UNIT 7- ILLUMINATION

Nature of light

Definitions: luminous flux, lumen, candle power, illumination, brightness, MHCP, MHSCP, reflection factor, absorption factor, maintenance factor, utilization factor.

Principle of production of light in filament & gas discharge lamp

Electric light sources: Incandescent lamp, Florescent lamp(including CFL),HPSV, HPMV, neon ,Halogen & their working principle. Stroboscopic effect

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction To Heating	4	6
2	Resistance Heating	10	12
3	Other Heating Methods	9	12
4	Arc Welding	8	9
5	Resistance Welding	5	6
6	Traction	14	15
7	Illumination	14	15
TOTAL		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	J.B.Gupta	Utilization of Electrical Power & Traction	S.K. Kataria & sons
2	G.C garg	Utilisation of electrical Power & Electric Drives	Khanna Publication
3	R.K.Rajput	Utilization of Electrical Power	Laxmi Publication
4	Tarlok Singh	Utilization of Electrical Energy	S.K.Kataria & sons

(EN404) ELECTRONIC INSTRUMENTATION

1. RATIONALE:

With the advancement of technology , measurement techniques have taken rapid strides with the introduction of different types of instrumentation devices This course is intended to enable the student understand the facts, concepts, principles and applications of the instrumentation systems and will be able to apply the same in almost all areas of electronics and communication required in installation, testing, and commissioning, especially related with transducers and control system.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EN 404 Electronic Instrumentation	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %:Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

UNIT I: INTRODUCTION TO INSTRUMENTATION

- Objectives of Instrumentation system
- Block diagram of a general instrumentation system and their functions
- Characteristics of ideal transducer
- Classification of transducers: Active and Passive transducers, Analog and Digital transducers.

Unit II: TRANSDUCERS BASICS

- Construction ,operation and characteristics of Passive transducers
- Resistive transducers: potentiometer, strain gauge(bonded and semiconductor),RTD,Thermistor
- Inductive transducer, varying of self inductance, mutual inductance ,reluctance, eddy currents,lvdt
- Capacitive transducer: varying of distance ,Area, Permittivity
- Active transducers
- Piezoelectric transducer: principle and materials used
- Thermoelectric: principle (Seeback effect) materials used
- Photoelectric: LDR, photodiode, photo transistor, photovoltaic cell
- Digital transducer: shaft encoder

Unit - III : TRANSDUCER APPLICATIONS

- Displacement measurement: linear and angular displacement using Resistive, Capacitive and Inductive transducers
- Angular Speed measurement: photoelectric pickup, magnetic pickup
- Pressure measurement: diaphragm with strain gauge.
- Vibration measurement :piezoelectric accelerometer
- Level measurement : float operated resistive method Capacitive
- Flow measurement: electromagnetic flow meter and turbine meter

Unit – IV: SIGNAL CONDITIONING AND DATA PRESENTATION

- Need for signal conditioning
- Amplifiers: DC . AC Amplifiers ,Instrumentation Amplifier
- Filters
- Bridge :basic of bridge circuits for strain gauge and RTD.
- Types of data presentation elements:
digital displays: advantages and comparison of LED,LCD
plotters: strip chart recorder,X Y plotter

Unit – V: APPLICATION OF INSTRUMENTATION SYSTEMS

- Data Monitoring: block diagram and list of applications areas
- Data Acquisition system : block diagram and list of applications areas
- SCADA :block diagram and list of applications areas
- Process Control: block diagram and list of applications areas

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1.	Introduction	6	9
2.	Transducer Basics	14	18
3.	Transducer Applications	14	21
4.	Signal conditioning	8	15
5.	Applications of Instrumentation systems	6	12
TOTAL		48	75

5. List of Experiments (any 8)

S. No.	Experiment
1.	Temperature measurement using thermocouple
2.	Temperature measurement using resistance temperature detector
3.	Study of light sensors:-photo transducers etc
4.	Displacement measurement using Linear Motion Potentiometer
5.	Displacement measurement using Inductive Transducer
6.	Displacement measurement using Capacitive Transducer
7.	Displacement measurement using lvdv
8.	Weight measurement using strain gauge bridge
9.	Speed measurement of motor using photo electric pickup
10.	Study of Piezoelectric transducer

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1.	Sawhney A.K.	Electrical & Electronic Measurement and Instrumentation	Khanna Publishers, Delhi, 2000
2.	Rangan, C.S., et al;	Instrumentation Devices and Systems	Tata McGraw Hill, New Delhi 1990
3.	Curtis Johnson	Process Control Instrumentation Technology	Pearson/Prentice Hall, 2006
4.	Cerni & Foster	Instrumentation for Engineering Measurements	Tata McGraw Hill, New Delhi 5 th , 1986
5.	Kalsi.H.S.	Electronics Instruments & Measurement	McGraw Hill India, 2 nd Edition 2004 ISBN: 978-0-07-058370-2
6.	Murty, D.V.S.	Transducers and Instrumentation	Prentice Hall of India, New Delhi, 2005 ISBN: 978-81-203-0953-1
7.	Doebelin	Measurement Systems: Application and Design	McGraw Hill, India, 2006 ISBN: 978-00-706-61672-1
8.	Anand B.	Electronic Instruments and Instrumentation Technology	Prentice Hall of India, New Delhi, 2006 ISBN:81-203-2454-4

(EE404) ELECTRICAL WORKSHOP PRACTICE

1. RATIONALE

Student will develop hand skill in repair of various electrical appliances and machine winding practice, and knowledge of connection of fluorescent tube, godown , staircase wiring required to be performed by electrical technician.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course title	Period/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Test		
	L	T	P	C	TH	TM	PR/OR	TW	
EE404 Electrical Workshop Practice	-	-	2	2	-	-	50(o)	25	75

3. SUGGESTED LIST OF EXPERIMENTS

Students are required to perform minimum six experiments.

Sr. No.	Experiment
1	Study of symbol of electrical equipment
2	PCB making (3 turns)
3	Connection of fluorescent tube and to measure operating voltage and conducting voltage, identify its apparatus.
4	Repair and maintenance of domestic appliances such as iron, ceiling fan, mixer, table fan hot plate, oven (2 turns)
5	Practice of coil winding (2 turns)
6	Study of MCB, MCCB, ELCB
7	Practice of Crimping of lug.
8	Sketching connection diagram and study of Godown, staircase, bell wiring circuit, one light, fan & socket circuit (2 turns)

(CS307) ELEMENTS OF MECHANICAL ENGINEERING

1. RATIONALE:-

In this modern scientific era, the field of engineering and technology is continuously expanding, with many newer branches of engineering being added day by day. Under present circumstances it is highly essential for an engineer and technician to acquire basic knowledge of some other relevant engineering fields, along with his own discipline of study. Also the technician carrying out plant maintenance requires basic knowledge of functions of mechanical elements & machines from operational and safety point of view. Hence this subject is being introduced in the curricula as an interdisciplinary subject to provide basic knowledge of mechanical engineering to the students of other engineering disciplines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
CS307 Elements of Mechanical Engineering	3		1	4	75	25	25	-	125

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

Unit 1 Mechanical Power Transmission (No mathematical treatment)

Introduction. Belt drives – classification & applications, technical specifications (power & cross sectional area). Chain drives – Types of chains and their applications. Gear drives – classification and applications, gear trains (simple & compound only) and their speed ratio. Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only), fluid coupling. Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications), bearing specification (4 digit bearing number).

Unit 2 Internal Combustion (I.C.) Engines (*No mathematical treatment*)

Introduction, classification & basic engine components. Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2stroke and 4 stroke engines. Technical specification of I.C. engines – Stroke volume, speed (rpm) & torque, power. Criteria for selection of I.C. Engines.

Unit 3 Thermal Engineering

Introduction. Basic components of a thermal power station and their function

(Condenser, Turbine, Boiler).

Boiler – Introduction, function, classification (water tube, fire tube), Construction and working of Babcock & Wilcox boiler and Cochran boiler. Comparison between fire tube and water tube boiler. Boiler mountings and accessories like- Safety valve, water level indicator, Economiser and superheater. Awareness to Indian Boiler Regulations i.e. IBR (Brief introduction only).

Unit 4 Refrigeration & Air conditioning (*No mathematical treatment*)

Introduction. unit of refrigeration (Ton), Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).

Air Conditioning- definition, working of Window and split Air conditioner, procedural steps in installation of Air conditioner.

Unit 5 Pumps (*No mathematical treatment*)

Introduction, working principle, classification. Centrifugal and reciprocating pump - construction & working. Common faults in working of pump and troubleshooting. Technical specifications - power, discharge, head.

Unit 6 Maintenance Engineering (*No mathematical treatment*)

Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup. Importance of lubrication schedule. Maintenance tools and their functions (no construction & working) – bearing puller, spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block, tripod.

Note to paper setters:-

Internal details of subcomponents of the following should not be asked-

- i) I. C. Engine systems.
- ii) Pumps.
- iii) Turbines and condensers

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	Mechanical Power Transmission	8	15
2	Internal Combustion (I.C.) Engines	12	18
3	Thermal Engineering	8	12
4	Refrigeration & Air Conditioning	8	12
5	Pumps	06	09
6	Maintenance Engineering	06	09
	TOTAL	48	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	UNIT No.	LIST OF EXPERIMENTS
1	1	Study of different types of gears.
2	1	Removal and mounting of belt. Checking tension in the belt.
3	1	Demonstration of mounting and removal of ball/roller bearing.
4	2	Study of petrol/diesel engine construction.
5	2	Study of petrol/diesel engine working.
6	3	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).
7	4	Study of any one refrigeration Air conditioning equipment working on simple vapour compression system.
8	5	Study of centrifugal and reciprocating pumps.
9	6	Literature survey and seminar (A brief power point presentation of around 15 min on any topic relevant to mechanical engineering). It may be done individually or in groups depending on class strength. <u>OR</u> Field visit to maintenance work shop and detailed report on maintenance to be presented by students.

6. SUGGESTED LEARNING RESOURCES

Sr. No.	AUTHOR	TITLE	PUBLICATION & YEAR
1	R.K. Rajput	Elements of mechanical engineering	Laxmi pub.
2	A.A. Karad & K.B. Kale	Elements of mechanical engineering	Technical Pub., Pune.
3	R.K. Rajput	A text book of Hydraulic Machines	S. Chand
4	K.R. Gopalkrishna	A text book of elements of Mechanical Engineering.	Subhash pub., Bangalore
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand
6	H.P. Garg	Industrial Maintenance	S. Chand
7	V. K. Manglik	Elements of Mechanical Engineering	PHI

(CS 311) ELEMENTS OF CIVIL ENGINEERING

1. RATIONALE:-

A broad based knowledge of elements of civil engineering is essential for Electrical/ Fabrication/ Air- conditioning engineering technicians. They are required to carry out the planning and layout of the power supply lines, supervise the erection of transformers and towers including providing foundations for these structures and heavy machinery. They are also required to select suitable construction materials on the field. Hence it is essential to gain adequate knowledge on reading the plans, foundations, setting out of lines, and measurement of land, concrete, structural frameworks, fire protection and insulation in buildings.

2. TEACHING AND EXAMINATION SCHEME

Course code and Course Title	Periods / Week (in hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
Elements of Civil Engineering (CS 311)	3	--	2	5	TH	TM	TW	PR/OR	125
					75	25	25	--	

Minimum passing % : Theory 40%

Duration of Theory paper: 3 hours

L: Lecture, T: Tutorial, P: Practical, C: Credits, TH: Theory paper, TM: Test marks, PR/OR: Practical or oral examination, TW: Term work.

3. DETAILED COURSE CONTENTS

<p>Unit 1. Surveying</p> <p>Definition of surveying, objects of surveying, uses of surveying, principle of Surveying, classification of surveying. Methods of linear measurements, instruments for Linear measurement Ranging:- Direct and Indirect (Reciprocal) Ranging Measurement of distances with chain, tape and other instruments. Chaining along a sloping line, to continue a line, measurement of the distance past an obstacle like building, valley etc.</p>
<p>Unit 2. Compass Surveying</p> <p>Introduction and purpose, definitions: Geographic Meridian, Magnetic Meridian, Arbitrary Meridian Knowledge of Bearings i) Whole circle Bearing ii) Quadratic or Reduced Bearing, study and use of Prismatic Compass. Local attraction, Fore bearing and Back bearing, computation of included angles.</p>

Unit 3. **Levelling**

1. Definition of technical terms in concept of leveling, A level line and a horizontal line, A level plane and a horizontal plane, Bench Mark and types, Backsight, Foresight, Intermediate sight, Change point, Instruments used for leveling – dumpy level, Tilting level, leveling staff Temporary adjustment of a dumpy level. Methods of Simple Levelling and Profile Levelling.
2. Calculation of reduced levels in a Levelling book by : (i) H.I. method (ii) Rise and fall method.

Unit 4 **Theodolite Surveying**

Introduction of theodolite, definition of technical terms in theodolite surveying: Line of collimation, Transiting, swinging, Face left and Face right observations, Study of a Transit theodolite and its parts.
Temporary adjustment of theodolite
Measurement of vertical angle, Measurement of horizontal Angle, Prolonging a straight line, checking vertically of poles or towers, computation of height of a tower by vertical angles and distance

Unit 5. **Building Construction**

Types of buildings: Load bearing and framed structures.
Components of building: Foundations, walls, columns, beams and slabs, roofs, flooring.
Foundations – Definition, purpose of foundation, bearing capacity of soils-ultimate bearing capacity , safe bearing capacity of soil
Types of foundation – Shallow foundations: spread footing, column footings, Raft foundation, Grillage foundation, Deep foundations: piles, Types of piles: Floating piles and End bearing piles, cast in situ piles and precast piles, cased and uncased piles, Caissons.
Flooring:- Types of floorings, flooring for Residential buildings, Office buildings, Factories, workshops and ware houses, Auditorium.
Roofs and Roofs coverings:-Classification of roofs: Flat and pitched roofs.
Roofs supporting structures- wooden and steel trusses, line diagram of various types of steel trusses: Fink, Pratt, Howe, Lattice girder, Northlight roof truss etc.
Roof covering: AC, G.I. Acrylic sheets, , Glass fiber sheets, aluminium sheets.
Fire Protection :- Fire resisting construction. Fire protection requirement / Measures for multi stored building and Industries
Insulation in Building: – Thermal insulation – material used, Sound insulation – material used Acoustical design of auditorium.

Unit 6. Concrete Technology

Types of Concrete, Ingredients of Concrete, Grades / Mix proportions of Concrete for various purposes.

Concreting: mixing, transporting, placing, compacting, curing, importance of water cement ratio. Concept of RCC, Pre-stressed Concrete. Grouting and its use.

Unit 7, Building Drawing

Elementary idea about Building, Plan Elevation and section, Symbols / conventions used including symbols for electrical fixtures. To draw elevation, plan and sectional details of two room residential building, Layout of an industrial building.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours	Marks
1	Surveying	5	6
2	Compass Surveying	5	8
3	Levelling	8	12
4	Theodolite Surveying	10	9
5	Building Construction	12	20
6	Concrete Technology	4	8
7	Building Drawing	4	12
Total		48	75

5. TERMWORK

Term work shall consist of practice on various topics mentioned below: student are required to maintain a journal where field observations / calculations are recorded.

1. Measurement of distance with chain
2. Chaining on a sloping ground
3. Reciprocal ranging
4. Study of compass and observation of bearings
5. Study of Dumpy level and simple levelling
6. Study of theodolite & observation of horizontal and vertical angles
7. Checking verticality of tower using theodolite and chain.
8. Prolonging a straight line using theodolite

A SKETCH BOOK CONTAINING THE FOLLOWING:

1. Signs and symbols used in Civil Engineering including electrical fittings
2. Spread footing of a wall
3. Column footing – an isolated and a combined
4. Raft foundation – Plan and a section
5. Grillage foundation
6. Line diagram of various roof trusses.
7. Section of a wall from foundation to roof, showing all the levels
8. Development of a plan, elevation, and section of a small residential building from a given line plan.

6. LEARNING RESOURCES

S.No.	Author	Title of the book	Publication
1	B.C. Punmia	Surveying Vol I & II	Laxmi Publication Ltd.
2	S.K. Duggal	Surveying Vol I & II	Mc. Graw Hill Education
3	N.N. Basak	Surveying & Levelling	Mc. Graw Hill Education
4	Sushilkumar	Building Construction	Standard publishers and Distributers
5	S. Ramamruthum	Building Construction	Dhanpat Rai & Sons
6	S.C. Rangawala	Building Construction	Charotar Publishers
7	Kale Shah & Patki	Building Drawing (V Edition)	Tata Mc.Graw Hill education

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Semester: V

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
EE501	Switchgear & Protection	4*	-	-	4	75	25	-	-	100
EE502	Power Electronics & Drives Control	4*	-	2	6	75	25	25	25	150
E1	Elective-I	4*	-		4	75	25	-	-	100
EE503	Electrical Drawing	-	-	3	3	-	-	50	50	100
IT501	Industrial Training	--	-	16	16	-	-	-	-	Grade
Total		12	-	21	33	300		150		450

***Workload shall be doubled**

E1 Elective-I

EE511-Distribution and Estimation

EE512- Electrical Safety Management

EE514 – Energy Systems (Non Conventional)

Semester VI										
Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
EE601	Electrical Drives	3	-	2	5	75	25	25	25	150
EE602	Substation Practices	4	-	2	6	75	25	25(O)	25	150
E2	Elective-II	3	-	2	5	75	25	25(O)	25	150
E2	Institutional Elective/Elective-II	3	-	2	5	75	25	25	25	150
CS602	Business Communication	-	-	2	2	-	-	50(O)	50	100
EE605	Project	-	-	6	6	-	-	50	50	100
Total		13	-	16	29	400		400		800

E2 Elective-II

EE611- Energy Management

EE612-Illumination Engineering

EN616-Industrial Automation

EE613-Testing & Maintenance of Electrical Machines

EE614-Introduction to 8085 Microprocessor

IE6** Institutional Elective

SEMESTER V

(EE501) SWITCHGEAR AND PROTECTION

1. **RATIONALE:** This course will enable the students to acquire knowledge about the principles and working of protective devices like fuse, circuit breaker etc. and understand the practices followed in protection schemes employed for electrical equipments & systems

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE501 Switchgear & Protection	L	T	P	C	TH	TM	TW	PR/OR	100
	4	-	-	4	75	25	--	--	

Minimum passing % :Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 :FAULTS

Nature & causes of faults, consequences of short circuit fault. Symmetrical faults & unsymmetrical faults. Calculation of short circuit MVA & current for symmetrical faults only, using per unit method. concept of current reactor & its classification based on location

Unit 2 – FUSES

Definition, advantages and disadvantages, desirable characteristics of fuse elements, terms related to fuses: current ratings, fusing currents, fusing factors, pre arcing time, cutoff current, arcing time, total operating time and breaking capacity. Types of fuses; LV fuses, (Re wirable or kit kat fuse), HRC Fuse. (working & construction). Comparison between rewirable & HRC fuse.

Unit 3 – CIRCUIT BREAKERS:

Main functions, Arc phenomena, (Initiation and maintenance of arc), Method of arc extinction (High resistance methods and low resistance or current zero method), Definition, Arc voltage, restriking voltage, recovery voltage, RRRV, Basic principles of operation and constructional features of MCB, MCCB, ELCB. Difference between fuse and circuit breakers.

Constructional features(with respect to arc extinction only), and working of air circuit breaker, Air Blast Circuit Breaker, minimum oil circuit breakers(Types of arc control devices), SF6 circuit breaker(puffer piston type only), vacuum circuit breaker, circuit breaker rating(rated voltage, rated current, rated frequency, operating duty, breaking capacity, making capacity), General specifications for procurements.

Concept of HVDC circuit breaker

Unit 4 – RELAYS (No numerical)

Definitions: Relay, Pick up, reset.

Fundamental requirements of protective relay, classification of relay based on Principle of operation

Construction and working of

1. Bucholz relay,
2. Bi metallic relay (basic concept)
3. Attraction type relay (hinged armature type & solenoid & Plunger type)
4. Induction relay,(shaded pole structure)
5. Induction type(over current relay, IDMT relay, Reverse Power Relay),

Concept of TSM & PSM in IDMT relay

Concept of Differential Protection , biased differential protection

Static relay: Introduction, advantages and block diagram for over current and differential protection.

Unit 5 – PROTECTIVE SCHEMES

Requirements of protective scheme, Concept of Main & Back up protection

Protection of three phase induction motors: stator winding protection, over current protection, , under voltage protection, unbalanced single phase protection.

Transformer protection: biased differential protection for transformers

Bus bar Protection: Differential protection and earth leakage protection,.

Protection of transmission lines: Time graded , current graded , (only for radial feeders)

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	Faults	6	9
2	Fuses	8	9
3	Circuit Breakers	18	24
4	Relays	12	18
5	Protective Schemes	20	15
	TOTAL	64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	J.B Gupta	Switchgear & Protection	S.K.Kataria & Sons
2	V.K.Mehta	Principles of Power Systems	S Chand
3	Sunil S Rao	Switchgear & Protection	Prentice Hall of India
4	U.A Bakshi, M.V. Bakshi	Switchgear & Protection	Technical Publication
5	Ravindranath & Chander	Power System Protection & Switchgear	New Age International

(EE502) POWER ELECTRONICS & DRIVES CONTROL

1. RATIONALE

This subject enables the student to understand the application of electronic principles in Power Electronics i.e the circuits that are rated at power level. Students will understand the applications of semiconductor devices such as SCR, DIAC, TRIAC, MOSFET, Transistors in power electronics.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE502 Power Electronics & Drive Control	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	25	25	

Minimum passing %: Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : INTRODUCTION TO POWER ELECTRONICS

Introduction & applications of power electronics,

Power electronics devices: SCR, DIAC, TRIAC, LASCR, IGBT, GTO, Power MOSFET, MCT. Their symbols & characteristics

Construction, characteristics & applications of General purpose diode, fast recovery diodes, Schottky diodes.

UNIT 2 – SCR:

Construction, two transistor model of thyristor,

Triggering methods – gate triggering, dv/dt triggering, light triggering, thermal triggering, and pulse triggering using UJT & PUT. Commutation in SCR, types of commutations (A ,B,C,D,E& F Type), Series & Parallel operation of SCR.

UNIT 3 - CONTROLLED RECTIFIER

Working principle of phase controlled convertor, single phase, Half wave, full wave and dual converter with R & RL load. (no analysis , only waveforms)

Concept of freewheeling diode,

Three phase - half wave, full wave & Dual converter. Expression for average & rms. value of voltage & current, (no derivation in each case).

UNIT 4 – A. C. VOLTAGE CONTROLLER & CYCLO CONVERTER

Principles of operation – ON-OFF control and Phase control. Single phase - half wave & full wave controller, with R & R-L Load.(no derivation)

Operating principles of cyclo converter, types: single phase to single phase, F/2, F/3 generating cyclo converter with centre tapped configuration.

UNIT 5 - CHOPPER & INVERTER

Definition, working principle, classification of chopper: First quadrant (class A), Second quadrant (class B), First and Second quadrant (class C) explanation with circuit diagram.

Basic working principle of inverter, Series Inverter, modified series inverter, Parallel inverter, single phase bridge inverter. (only waveforms)

UNIT 6 - . SMPS & SOLID STATE SWITCHES:

Block diagram of SMPS

Circuit diagram & working of - Buck regulator, Boost regulator, Buck- Boost regulator

Advantages of solid state switches,

A.C Switches: single pole thyristor a.c switch & single pole Triac a.c switch.

D.C. switches: single pole thyristor d.c switch, single pole transistor d.c switch, single pole G.T.O d.c switch,

UNIT 7- . A.C.MOTOR CONTROL:

Stator voltage control, rotor voltage control, frequency controls, voltage to frequency controls.

UNIT 8: PROTECTION OF POWER ELECTRONICS DEVICES

dv/dt protection, di/dt protection, Snubber circuits, cooling & heat sinks

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS
(THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction To Power Electronics	8	12
2	SCR	8	12
3	Controlled Rectifier	8	9
4	A. C. Voltage Controller & Cyclo Converter	8	9
5	Chopper & Inverter	12	12
6	Smpps & Solid State Switches	8	6
7	A.C. Motor Control	8	9
8	Protection Of Power Electronics Devices	4	6
TOTAL		64	75

5. List of Experiments: Any 8-10

1. To study the Volt ampere characteristics of SCR
2. To study V-I characteristics of UJT
3. To study characteristics of TRIAC & DIAC
4. To study V_I characteristics of PUT
5. To study the (a) Resistance triggering, (b) Resistance capacitance triggering, (c) UJT Triggering of SCR
6. To study of cycloconverter
7. Study of SCR series inverter
8. Study of chopper circuit
9. Study of light dimmer
10. Study of dv/dt triggering
11. Study of speed control of D.C. motor using SCR.
12. Study of v/f control scheme for three phase Induction motor.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	M.H. Rasheed	Power Electronics	Pearson
2	Alok jain	Power Electronics	Pernam International
3	P.C.Sen	Modern Power electronics	S chand
4	S.K. Bhattacharya	Industrial Electronics Drives & Control	Tata Mc Graw Hill
5	Bimal K. Bose	Modern Power Electronics & AC Drives	PHI

(EE503) ELECTRICAL DRAWING

1. RATIONALE: This course is aimed at developing basic knowledge & skills to draw electrical related Drawings & make use of Computer for drawing.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	PR/OR	TW	
EE503 Electrical Drawing	-	-	3	3	-	-	50	50	100

Minimum Pass Marks: Theory-35%; Practicals-50%

Legends L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

Term Work shall consists of minimum 5 Full imperial size OR 10 Half imperial size Drawing Sheets or these can be drawn using a drafting software like Autocad (Atleast 2 sheets must be drawn on Drawing sheets)

1. Transformer Details : (core, winding , tank & other accessories)
2. Motor Starters (4-point starter, DOL starter, Star Delta Starter { Manual & Automatic }, Autotransformer starter, rotor resistance starter)
3. Layout of pole mounted substation
4. Transmission line components
5. Electrical wiring diagram for Refrigerator, Window AC, Small Oven, HPMV Lamp, HPSV Lamp, Tube light .
6. Designing & Drawing control circuit for a given operation
7. Drawing Single line diagram of High Voltage (220KV or 110 KV substation)

(IT501) INDUSTRIAL TRAINING

1. RATIONALE:

Industrial Training is a newly introduced component, in the curriculum under Revised Semester Pattern system for all 03 year Diploma Programmes. It is a Training programme designed to expose & prepare the students for the Industrial work situation. This exposure and hands on experience, will further enhance the prospects of student fraternity to be better placed on completion of their course.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory		Practical		
	L	T	P	C	TH	TM	PR/OR	TW	
IT501 INDUSTRIAL TRAINING	-	-	16	16	-	-	30	70	Grade

Minimum passing %: 40%

Legends:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

Students are required to study and have hands-on experience wherever possible in the following areas (depending on availability):

1. Company Profile
2. Organizational Structure
3. Company Product Range
4. Manufacturing Facilities Available /Services provided
5. Plant / Facility Layout
6. Operations / Production Processes
7. Production Planning and Control
8. Detail study of Latest Equipment/ Technologies Used
9. Stores Functions
10. Material Handling Systems/ Equipments
11. Quality Management Systems / Functions
12. Maintenance and Repair Practices
13. Safety Practices / Safety Equipments
14. Utilities
15. Logistics
16. Sales and Marketing
17. Ethics, Statutory Rules and Regulations followed

18. Product Design and Development
 19. Any other area specific to the Industry providing Training

4. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				PR/OR	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
10	20	20	20	30	100

* 01 mark shall be deducted for every Absence (with or without permission).

Daily Dairy

The daily dairy should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be counter signed by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report

The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, including environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

Note :

- a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.
- b. Industrial Training will generally be organised and conducted in accordance with Industrial Training Manual duly prescribed by the Board.

5. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No	Name of the Unit	Teaching Hours	Marks
1	PR/OR	} 08 Weeks	30
2	TW		70
	Total	08 Weeks	100

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:

- 80% and above Marks – Grade ‘A’
- 60% to 79% Marks – Grade ‘B’
- 40% to 59% Marks – Grade ‘C’

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Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade 'C' for passing.

(EE511) DISTRIBUTION & ESTIMATION

1. RATIONALE:

This course will enable the students to know facts, procedure, I.E. rules and standard practices related to distribution of power in locality, domestic and industrial installations. The student will acquire the knowledge of planning, drawing of layout & Estimation of quantity of material for a given installation

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/O R	
EE511 Distribution & Estimation	4	-	-	4	75	25	-	----	100

3. DETAILED COURSE CONTENTS:

<p>UNIT1 DISTRIBUTION SYSTEM Classification Concept of feeder, distributor & Service mains Types of distributors: Radial, ring, interconnected. System voltage & permissible voltage drop in various parts of distribution system for urban, suburban & rural areas</p>
<p>UNIT2 DESIGN OF AC DISTRIBUTOR L.T. distributor Selection of size of conductor & its types, standard sizes used for distributors Calculation of inductive reactance & resistance of line (No derivation) Calculation of voltage drop & losses in radial distributors fed from one end using voltage regulation constant method & in ring distributors using impedance method</p>
<p>UNIT 3 ESTIMATION OF DISTRIBUTION SYSTEM Components of distribution line & their functions Layout of distribution line and 11KV feeder indicating pole position, stay set position and earth electrode. Preparation of material schedule for 3 phase, 440 V & 11KV a.c. radial distribution line. Estimation of capacity of distribution transformer for particular locality.</p>

UNIT 4 RURAL ELECTRIFICATION

Types & sizes of conductors used.
 Standard rating of transformers.
 Special features of
 a) SWER
 b) ABC

UNIT 5 DOMESTING WIRING

Types of wiring system: Cleat , PVC casing & capping, Conduit (surface & concealed) & their comparison.
 I.E. Rules and standard practices relevant to light & fan wiring and power wiring
 Planning and layout of domestic installation including Staircase & godown wiring
 Estimation of quantity of material for a given installation.

UNIT 6 INDUSTRIAL WIRING

Planning and layout of industrial switch boards and panels for
 a. Power circuit
 b. Calculation of main switch rating

Methods of wiring in industrial installations
 a. Cable system
 b. Bus way system (overhead)

Planning and selection of (i) size of wires (ii) Rating of other components.
 Layout of electrical installation for motors in small scale industry.

UNIT 7 EARTHING

Importance of earthing ,Concept of system earthing & equipment earthing
 I.E. Rules and standard practices relevant to equipment earthing
 Methods of earthing i) Pipe ii) Plate
 Factors affecting earth resistance
 Ways & means to reduce earth resistance

Suggested Activities:

1. Visit to 11 KV LT distribution to identify its components.
2. Visit to small scale industry

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Distribution System	6	9
2	Design Of AC Distributor	10	12
3	Estimation Of Distribution System	12	12
4	Rural Electrification	6	6
5	Domesting Wiring	12	15
6	Industrial Wiring	12	12

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Unit No.	Topic	Teaching Hours/ Semester	MARKS
7	Earthing	6	9
TOTAL		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Raina, Anand, Singal	Transmission & distribution of Electrical Energy	
2	Raina , Bhattacharya	Electrical Design Estimating & costing	New Age International
3	A.S. Pabla	Electrical Power distribution	Tata Mc Graw
4	B.D.Arora	Electrical wiring Estimation & costing	New Heights
5	J.B.Gupta	Electrical Installation Estimation & costing	Katson

(EE512) ELECTRICAL SAFETY MANAGEMENT

1. RATIONALE

The course will enable the learner to understand various safety aspects with respect to electrical systems including first aid ,work permits ,safety clearances etc. The students will also know about Indian electricity rules & Indian electricity act .They will also know about electric shock and their prevention

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE512 Electrical Safety Management	L	T	P	C	TH	TM	TW	PR/OR	100
		4	-	-	4	75	25	--	

Minimum passing % :Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

<p style="text-align: center;">UNIT1 : INTRODUCTION TO ELECTRICAL SAFETY AND SAFETY MANAGEMENT</p> <p>Dangers from electricity, Safety precautions, Safety inspection, Indian electricity acts and rules (1965), Causes and preventive measures, Hazards associated with electric current and voltage, Principles of electrical safety, Approaches to prevent accidents, Fire prevention and fire fighting</p>
<p style="text-align: center;">UNIT 2 – ELECTRICAL SHOCKS AND THEIR PREVENTIONS:</p> <p>Primary and secondary electric shocks, Occurrence of electric shocks, Shocks from 3-phase A.C system, Severity of electric shocks, Medical analysis of electric shocks and its effects, AC shocks v/s DC shocks ,Lightening shocks on overhead transmission lines and outdoor substation , Prevention of shocks, Safety precautions against contact shocks, flash shocks and burns, Safety precaution in small LV installations, residential buildings, shocks, Safety procedure in electrical plants, Sequence of operation for circuit breaker isolators and earthing switch.</p>
<p style="text-align: center;">UNIT 3 – FIRST AID</p> <p>Removal of contact with live conductor, First principles of actions after electric shocks, Artificial respiration, Schafers prone pressure method, Silvester’s method, Nielson’s arm –lift back pressure method, Mouth to mouth method, Use of artificial resuscitator, External cardiac massage, Chocking, Poisoning, Open wound, Control of bleeding, Burns and scalds, Accident</p>

management and safety management

UNIT 4 – EARTHING

Distinction between system earthing and equipment earthing, earthing systems in electrical substations or electrical plants, requirements of earthing system, concept of step potential and touch potential

UNIT 5 – SAFETY - CLEARANCES AND CREEPAGE DISTANCES IN ELECTRICAL PLANT AND EQUIPMENT

Definitions of Clearance, Creepage distance, Clearance to earth, Clearance between phases.

Clearances between Phase to earth, Phase to phase.

Safety clearance (section clearance), Ground clearance & Creepage distances (leakage distances).

UNIT 6- SAFETY DOCUMENTATION AND WORK PERMIT SYSTEM

Significance of safety documentation and work permit system, List of safety documents in electrical work, Responsibilities of parties in electrical and fire safety, Limited work permit (LWP), Permission to test, Safety key procedure, Safety tag system, Control of work permit, Safety aspects while taking an equipment/installations back in service, Safety aspects during recommissioning after major maintenance/ repair work

UNIT 7- REVIEW OF INDIAN ELECTRICITY RULES AND INDIAN ELECTRICITY ACTS AND THEIR SIGNIFICANCE

Objectives and scope of IE act and IE rules, Classification of Electrical installations, Metallic earthed fences for switchyards, Clearances between lowest point of conductor and ground for transmission lines and distribution lines, Electrical safety –general requirements as per IE rules

- i) Rule 77 Clearance above ground of the lowest conductor
- ii) Rule 79 Clearance from buildings of low and medium voltage lines
- iii) Rule 80 Clearance from building of high and extra high voltage lines

UNIT 8- ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL, AGRICULTURAL INSTALLATIONS AND HAZARDOUS AREAS

Wiring and fitting, do's and dont's for safety in the use of domestic electrical appliances, Principles of safety management, Safety organization, Hazardous zones class 0, 1 and 2, Sparks, flashovers and corona discharge associated with electrical equipment and plant.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction to electrical safety and safety management	6	6
2	Electrical shocks and their preventions	11	12
3	First Aid	11	12
4	Earthing	5	6
5	Safety - clearances and creepage distances in electrical plant and equipment	7	10
6	Safety documentation and work permit system	11	12
7	Review of Indian electricity rules and Indian electricity acts and their significance	8	9
8	Electrical safety in residential, commercial, agricultural installations and Hazardous areas	5	8
TOTAL		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	S.Rao & S.L.Saluja	Electrical Safety, Fire safety Engineering and safety management	Khanna Publication
2			

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(EE514) ENERGY SYSTEMS (NON CONVENTIONAL)

1. RATIONALE

This course on renewable energy technologies will enable the student to understand the basic facts, concepts, principles and procedures related to various renewable energy technologies.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE 514 Energy Systems (Non Conventional)	L	T	P	C	TH	TM	TW	PR/OR	100
	4	-	-	4	75	25	--	--	

Minimum passing % :Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : ENERGY SOURCES

Classification of Energy Sources, Consumption Trend of primary energy sources, advantages and disadvantages of conventional energy sources, importance of non-conventional energy sources, advantages and disadvantages of non-conventional sources, energy scenario in India.

UNIT 2 – SOLAR THERMAL SYSTEMS

Types of solar collectors (construction and working of liquid flat-plate collector and central tower receiver collector only), comparison between concentrating and non-concentrating solar collector. Water heater, solar cooker (box type and paraboloidal dish type). Solar furnace, solar greenhouse (typical winter green house and typical summer green house), solar drier and solar distillation-construction, working and application.

Any two case studies in brief

UNIT 3 – SOLAR PHOTOVOLTAIC SYSTEMS

Definitions, advantages and disadvantages of solar photovoltaic systems, solar PV panels, solar PV arrays (no numerical) solar PV system classification (standalone solar PV system, grid interactive solar PV system and hybrid solar PV system), solar PV applications (water pumping and lightning).

Any two case studies in brief.

UNIT 4 – SOLAR PV SYSTEM COMPONENTS AND SIZING

Solar PV system components and wiring – DC system with battery, series and parallel circuits, grid tied system with and without batteries, solar charge controller, system with DC and AC load system equipment grounding schematic, grid tied system with and without battery backup.

Sizing of solar PV system for a given load.

Any two case studies in brief.

UNIT 5 – WIND ENERGY

Introduction, factors affecting the distribution of wind energy on the surface of the earth, block diagram of wind energy conversion system, environmental concerns, wind energy programs in India.

UNIT 6- ENERGY STORAGE SYSTEMS

Energy storage systems – working principle for the following: Thermal storage: -Packed bed storage type;

Electrical storage: - battery storage type.

Mechanical storage: Pumped hydroelectric storage, compressed air storage, fly wheel storage;

Solar Pond: - Principle of operation, description of non-convective solar pond, applications.

UNIT 7- BIOMASS

Introduction, photosynthesis process, advantages and disadvantages of biomass, biomass resources, biomass conversion technologies, urban waste energy conversion (MSW incineration plant) types of biogas plants (floating drum type, fixed dome type biogas plant).

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Energy Sources	12	14
2	Solar Thermal Systems	12	14
3	Solar Photovoltaic Systems	10	12
4	Solar PV System Components & sizing	12	14
5	Wind Energy	8	9
6	Energy Storage Systems	4	4
7	Biomass	6	8
TOTAL		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	B.H.Khan	Non-Conventional Sources of Energy	TMH,II Edition
2	G.D.Rai	Non-Conventional Sources of Energy	Khanna Publication
3	Pankaj Som	I Know Solar Now	Solar Energy , Review

SEMESTER VI

(EE601) ELECTRICAL DRIVES

1. RATIONALE

This subject enables the student to understand the working principle, construction, performance, control and applications of electrical machines such as DC Generator, DC motor & Transformers. The students get familiarized with the various constructional parts, classification, operation, fault finding & trouble shooting of these machines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE601 Electrical Drives	L	T	P	C	TH	TM	TW	PR/OR	150
		3		2	5	75	25	25	

Minimum passing % :Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : INTRODUCTION TO ELECTRIC DRIVE

Concept of electrical drive, classification of electrical drive, Merits & demerits of individual drive, group drive & multi motor drive, Factors governing selection of motor.

UNIT 2 – DYNAMICS OF ELECTRIC MOTOR (NO NUMERICAL)

Types of loads, load torques, four quadrant operation of a motor, variation of load torque with respect to angular displacement of shaft.

Concept of stability of drive system & steady state stability (No analysis), determination of referred load torque & referred moment of inertia to motor shaft. Joint speed torque characteristics of electric motor & driven unit.

UNIT 3 – BRAKING OF MOTORS

Definition & its purpose: Advantages & Disadvantages of electrical braking .

Types of electric braking

Dynamic, regenerative & counter current braking for D C shunt & series motors

Dynamic, regenerative & counter current braking for Three phase squirrel cage

Induction motors

UNIT 4 – SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

Pole changing method, voltage control, frequency control, voltage to frequency controls (v/f control), Rotor rheostat control, slip power recovery control(Kramer control method only), cascade connection, Schrage motor

UNIT 5 – RATING & HEATING OF MOTORS

Heating effect. Heating & cooling curves (no derivation) ,classes of duty, types of enclosures as per IS 4722.

Determination of power rating of electric motor :continuous duty & variable load.

Effect of load inertia, Load equalization

environmental factors affecting rating of motors.

UNIT 6 – CONTACTOR CONTROL CIRCUITS:

Components – Push buttons, overload relay, limit switches, float switches, time delay relay, selector switch.(their symbols & use only)

Basic principles of control circuit – Interlocking control, sequential control of motor, sequential controls with TDR, Automatic sequential control

Schematic control circuit & Power circuit diagram for reversal of direction of rotation of motor – direct & indirect, motor fed from two sources, remote control of an induction motor.

UNIT 7- INDUSTRIAL APPLICATIONS OF ELECTRIC DRIVES

Study of drive motors for following applications :

Lathes, refrigeration & air conditioning, pumps, lifts, cranes & machine tools.

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS
(THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction To Electric Drive	03	03
2	Dynamics Of Electric Motor	08	12
3	Braking Of Motors	09	12
4	Speed Control Of Three Phase Induction Motor	08	09
5	Rating & Heating Of Motors	06	12
6	Contactor Control Circuits	08	18
7	Industrial Applications Of Electric Drives	06	09
TOTAL		64	75

5. List of Experiments : Any 8

1. Study of symbols of different components of contactor control circuits
2. .Study of dynamic braking in d.c. shunt motor
3. Study of plugging in 3 phase induction motor
4. Speed control of 3 phase Induction motor by e.m.f. injection(Schrage motor)
5. Speed control of 3 phase Induction motor by pole changing method.(a)Two pole, (b)Four pole, (c) Six pole, (d) eight pole.
6. Design; assemble & testing of control circuit for interlocking operation in 3 phase a.c. induction motor.
7. Design, assemble & testing of control circuit for sequential control operation with time delay between two induction motor.
8. To study the drive system & control circuit of lathe machines
9. To study drive system & control circuit of milling machine.
10. To study drive system & control circuit of radial drilling machine.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	S.K.PILLAI	A first course on electrical drives	
2	DUBEY	Fundamentals of Electric Drive	Tata Mcgraw
3	V.Subramaniam	Electric Drives	Tata Mcgraw
4	S.K. Bhattacharya	Industrial Electronics & Control	Tata Mcgraw
5	U.S.Eshwar	Handbook of Electric Motor Control	

(EE602) SUBSTATION PRACTICES

1. RATIONALE:

Electrical substations form the important component in electrical power system network. The course contents are designed to make the students understand the concepts and practices followed in the substations, Layout & various components used in the substations.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE602 Substation Practices	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	25	25(o)	

Minimum passing %:Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

<p>UNIT1 : INTRODUCTION Classification of substation, on the basis of services rendered, operating voltage & construction (indoor, outdoor, and underground) Indoor sub-station, outdoor: pole mounted, gas insulated substation & its features ,comparison between indoor & outdoor substations Selection of site for a substation.</p>
<p>UNIT2: SUBSTATION COMPONENTS & LAYOUT Components for substation & their function & symbols– bus bars, insulator, circuit breaker , isolators , earthing switch, CT, PT, Line trap, Lighting Arrester ,transformer single line diagram of 11 KV/440 V pole mounted substation,220/110KV, 33/11 KV substation. PLCC components and their functions</p>
<p>UNIT3: BUSBARS Arrangement: single bus bar , single bus bar with bus sectionalisation, main & transfer, double bus bar with 1 breaker, double bus bar with 2 breaker, 1&1/2 breaker, ring main arrangement.</p>
<p>UNIT4: CT & PT Definition -Use of instruments transformer, Concept of Ratio error , phase angle error , burden, Definition of composite error C.T.construction – wound type, bar type, clamp on ammeter, effect of secondary open circuit, difference between CT for measurement & CT for protection</p>

<p>General specifications for procurement, P.T: :construction of potential transformers, CVT, Difference between C.T. & P.T., General specification for procurement.</p>
<p>UNIT5: CONTROL ROOM Types of Control panels – corridor type & cubical type, Mimic diagram (connection of isolator, earthing switch & circuit breaker to bus bar) control and indicating equipment in panel (Audio and visual)</p>
<p>UNIT6: SUBSTATION EARTHING Permissible values for large, major & small substation . -Earthing mat (descriptive statement), Concept of Isolated neutral, grounded neutral comparison between grounded neutral & isolated neutral types of neutral earthing : solid grounded, resistance & reactance concept for step potential & touch potential, methods to reduce them</p>
<p>UNIT7: PROTECTION AGAINST OVER VOLTAGES AND LIGHTNING Causes of overvoltage(Internal cause, external cause), internal cause – switching.insulation failure, resonance . _External causes – lightening, harmful effects of lightning. Protection against lightening – earthing screen, overhead ground wires, lightening arresters Lightening arrester – definition, types: horn gap, metal oxide, valve type Surge absorbers: definition, capacitor & reactor type</p>
<p>UNIT 8: TARIFF & POWER FACTOR IMPROVEMENT Tariff – definition, objective of tariff, desirable character of tariff. Types – Simple rate tariff, , block rate, two part, max. demand Tariff, power factor. tariff Power factor improvement – definition, disadvantages of low power tariff, causes of low p.f., importance of p.f. improvement, equipment for p.f. improvement .(capacitor, synchronous condenser) Calculation of p.f. correction and (Simple numerical).</p>
<p>UNIT 9: CABLES General construction of cable, construction of PVC & XLPE cable. classification of cables based on voltage & number of cores , Methods of laying cables Direct laying Draw in system Solid system, Their advantages and disadvantages. factors affecting current carrying capacity. Selection of cable based on current carrying capacity & permissible voltage drop Comparison between power cables & control cables,</p>
<p>UNIT10 : MAINTENANCE OF SUBSTATION ACCESSORIES Testing of transformer oil, measures to improve quality. Reactivation of silica gel . Batteries: Basic working of lead acid cell , care & maintenance of batteries , hydrometer & its use Charging methods : Constant voltage, constant current , taper voltage & two rate charging & trickle charging Safety precautions in carrying out works in substation Concept of line clearance</p>

4. LIST OF EXPERIMENTS : (Any 8)

1. Testing of Earth Fault relay
2. Testing of CT & PT (ratio & polarity test)
3. Testing of overcurrent Relay
4. Testing of Overvoltage/ under voltage relay
5. Cable acceptance Tests
6. Study of pole mounted substation
7. Study of 33KV / 11 KV substation (Field visit)
8. Study of 220 KV or 110 KV substation (Field visit)
9. Cable Fault location testing
10. Testing of transformer oil (Dielectric strength)
11. Study of Cable Laying Methods
12. Study of HVDC & Traction Substation

5. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Introduction	6	6
2	Substation Components & Layouts	4	6
3	Bus Bars	4	6
4	CT & PT	6	6
5	Control Room	2	3
6	Substation Earthing	6	6
7	Protection Against Overvoltages & Lighting	6	6
8	Tariff & Power Factor Improvement	8	12
9	Cables	10	12
10	Maintenance Of Substation Accessories	8	12
TOTAL		64	75

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	V.K.Mehta	Principles of Power System	S.Chand
2	S.Rao	Electrical Substation Practice	Khanna Publications
3	Sharotri	Preventive Maintenance of Electrical Appliances	
4	P. V. Gupta, P. S. Satnam	Substation Design & Equipment	

5	V.K.Jain	Bulk Electric Supply & distribution	Galgotia Booksources
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(CS602) BUSINESS COMMUNICATION

1. RATIONAL :

The course on Business Communication will help in development of speaking, listening, writing, and reading skills in students, with special reference to business environment like writing business letters, notes, reports, documents, holding meetings and discussions, working in groups, etc. . Special provision has been made for language workshops where the communication skills of the students can be enhanced.

2. Teaching and Examination Scheme :

Course Code & Course title	Periods per week in hours			Total credits	Examination scheme				
					Theory Marks		Practical Marks		TOTAL Marks
	L	T	P		C	TH	TM	PR/OR	TW
EE602 Business Communication	-	-	2	2	-	-	50	50	100

3. Competences to be developed through this course :

The course content should be taught and implemented with the aim to develop different type of skills leading to the achievement of the competency “Communicate effectively in given Business situations”.

4. Detailed Course Content :

<p>Unit 1.1: Communication Skills in the work place Communication within the organizational, Types of communication, functions of Internal & external communications Definition, components, importance of effective communication skills, types- verbal-non verbal, methods and hints to improve communication skills, body language, Précis and comprehension</p>
<p>Unit 1.2: Modern Office technology for communications: Using technology and internet to obtain information about suppliers, their credibility, latest specification of items, contacting people, quick feedback, social networking, skype, whatsapp, spell check, dissemination of information, send email to staff, paperless office, etc</p>
<p>Unit 2.1: Seminars Objectives, topic selection, audience, structure, tips for good beginning and end, aids</p>

to presentation.

<p>Unit 2.2: Project work: A link between the theory and the practical Narrow down to the topic, specific not vague, data collection, structure, critical thinking and analysis.</p>	<p>Tips:</p>
<p>Unit 3.1 : Report writing: Understanding Objective and Subjective report writing (i)<u>Feasibility report:</u> Definition, types, economic feasibility, technical feasibility, definition. (ii) <u>Trouble Report:</u> Purpose, instances when trouble reports are written, procedure followed in writing trouble report (iii) Formal Reports: Essay, Pamphlet, Booklet or Book report, Parts of a book Report, understanding how to write formal reports</p>	
<p>Unit 3.2 : Illustrations in a report: Uses, types, Use of illustrations: Tables, graphs, charts, Venn diagram, organizational charts, flow charts, maps, photographs, drawings and diagrams.</p>	
<p>Unit 4.1: Topic -Letter writing: Credit letter, Collection and sales letters</p>	
<p>Unit 4.2: Memorandum: Definition, difference from letter, examples of memorandum</p>	
<p>Unit 5.1: Meetings: Preparation, Notice for the meetings, Agenda</p>	
<p>Unit 5.2.: Note taking during meetings, minutes of meeting</p>	
<p>Unit 6.1: Tender: Procedure, Preparation, Types of tenders, Single tender, local tender, e tender, Structure, Tender Notice, Terms and conditions, Payment details, specification, Documents to be submitted, placing orders, Evaluations, drafting advertisements for tenders</p>	
<p>Unit 7: Job Interviews: Preparing for a Job Interview, guidelines on facing job interviews, ways of scouting for jobs, Writing Job Application, resume,</p>	

Marking scheme :

Term Work	Maximum marks
Overall classroom performance.....	10
Workbook (assignments).....	25
Classroom activity (language workshop).....	15

Term End Assessment

Components	Maximum marks
Questions on syllabus.....	20

Activity.....30

4. Suggested specification table with hours and marks (Practical) :

Unit No	Topic	Teaching hours per semester
1.	Communication Skills in the work place	04
2.	Organizing seminars, project work	04
3.	Report writing	05
4.	Letter Writing	05
5.	Meeting	05
6.	Tenders	04
7.	Job interviews	05
	Total hours	32

5. Suggested learning resources :

1. Business Correspondence and report writing, by R C Sharma & Krishna Mohan, Tata Mcgraw hill, New Delhi 2002,
2. Principles and practices of Business Communication ,Doctor R. Doctor A., Seth Publishers,14th edition,2006
3. The functional aspects of communication skills, P. Prasad, Sharma K. Rajendra, S. K. Kataria and Sons,2006
4. Raul R. Timm, How to make winning presentations, Sneha printers, Mumbai,
5. Stand and Deliver, how to become a masterful communicator and public speaker,
6. Dale Carnegie Training, CPI Cox & Wyman, UK.

(EE605) PROJECT

1. RATIONALE

This phase-II of the project report is intended to integrate the entire major project by which several skills and competencies which have been developed in the students during his/her course of study and gets manifested through this project.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE605 Project-Phase-II	L	T	P	C	TH	TM	PR/OR	TW	100
	-	-	6	6	-	-	50	50	

Minimum Pass Marks: Theory-35%; Practicals-50%

Legends L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

The following are some of the suggested activities, which the student has to undertake (which may slightly differ depending on the project chosen) during the project work. In so doing some process related and project related skills need to be evaluated.

1. Selection/Identification of project Work by market survey/industrial survey.
2. Project Proposal
3. Market survey for product sales & economic viability of product
4. Costing of the project/product
 - i. Capital costs
 - ii. Material & production cost
5. Design of project to obtain desired output.
6. Procurement of components & equivalents.
7. Working skill of fabrication.
8. Testing of product
 - i. Drafting
 - ii. Sketching
 - iii. Layout
 - iv. Presentation

9. Project Report

(EE611) ENERGY MANAGEMENT

1. RATIONALE

The need to conserve energy has now been universally acknowledged in order to save the scarce fast depleting energy sources and increasing cost of generating plant. This subject is designed to make aware the diploma engineering of the importance of demand side management in industry. It will develop the competency to identify the areas of losses and ways & means to reduce energy consumption and also improve demand factors so that optimum and most efficient use of energy can be made.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE611 Energy Management	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25(O)	

Minimum passing % :**Theory** 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : INTRODUCTION

Concept of supply side and load side energy management. Quality of incoming supply and its effect on the performance of machinery, equipment, lighting etc.

b) definition of demand factor, diversity factor, load factor, load curve, importance of flattening of load curve and methods to achieve it, classification of loads.

UNIT 2 – GENERAL ASPECTS OF ENERGY MANAGEMENT

Energy security, energy conservation and its importance, energy strategy for the Future, Energy Conservation Act 2001 and its features.

UNIT 3 – ENERGY AUDIT-CONCEPT AND PURPOSE

Energy audit measuring instruments(brief description), need for energy audit, classification of energy audit, preliminary and detailed audit.

UNIT 4 – TARIFFS:

Objectives and basis for differential structure of tariffs, components of tariff structure, demand curve and calculation of maximum demand.

UNIT 5 – ELECTRICAL LOAD MANAGEMENT, MAXIMUM DEMAND CONTROL

AND POWER FACTOR IMPROVEMENT

Need for electrical load management, step by step approach for maximum demand control.

Advantages of p.f. improvement, cost benefits of p.f. improvement, kVAR calculations.

UNIT 6 ENERGY PERFORMANCE ASSESSMENT

i. Motors: Performance terms & definition, efficiency, motor loading, efficiency testing based on motor specifications & no load test data, determination of motor loading by various methods.

ii. Lighting System: Performance term & definitions, lumen, lug, circuit watts, installed load efficiency, lamp circuit efficiency, installed power density, average maintained luminance,

color rendering index. Preparations before measurements, procedure for assessment of lighting

systems, list of areas for improvement.

iii. Water Pumps: Performance terms and definitions, pump capacity, total developed head,

system resistance, pump efficiency and hydraulic power. Procedure for determination of pump efficiency.

UNIT 7:ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS: (ONLY DESCRIPTION):

Maximum demand controllers, automatic power factor controllers, energy efficient motors-

Minimizing watts loss in motors, technical aspects of energy efficient motors; soft starters

& its advantages, variable frequency drive- Concept, VSD power conversion, energy efficient

Transformers, Electronic ballast- role of ballast, conventional v/s electronic ballast, Energy efficient

lighting controls- Occupancy sensors, timed based control, daylight linked control, localized switching , Energy efficient lighting system.

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS
(THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction	2	6
2	General Aspects of Energy Management	4	6
3	Energy Audit-concept and Purpose	4	6
4	Tariffs	6	9
5	Electrical Load Management, Maximum Demand Controller and Power Factor Improvement	8	12
6	Energy Performance Assessment	14	18
7	Energy Efficient Technologies in Electrical Systems	10	18
TOTAL		48	75

5. List of case Study Assignments : (Any Two)

1. Energy audit and conservation in a small industry or institute or hospital
2. Energy audit and conservation in distribution system.
3. Power factor improvement.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	A.S.Pabla	Electric Power Distribution System	
2		Conservation of Electrical Energy	Published by AICTE
3		General Aspects of Energy Management and Energy Audit Guide book1	Bureau of Energy efficiency ,India
4		Energy Efficiency in Electrical Utilities, Guide Book 3	Bureau of Energy efficiency ,India
5		Energy Performance Assessment for Equipment and Utility Systems Guide Book 4	Bureau of Energy efficiency ,India
6			

(EE612) ILLUMINATION ENGINEERING

1. RATIONALE

This course will enable the student to understand the principles of lighting schemes, characteristics and specific applications of lighting sources. This course will also help the student to design basic lighting schemes for indoor as well as outdoor applications.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
EE612 Illumination Engineering	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25(O)	

Minimum passing % : **Theory** 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : INTRODUCTION TO LIGHT

Definition of light, white light, natural light, artificial light, supplementary light, qualities of good lighting, factor affecting good lighting – Glare & its types, Hard shadows, soft shadow, contrast & its levels between visual task, working plane, surrounding & field of vision, colour rendering effect & CRI. Reflection factor, stroboscopic effect, its causes & ways to minimize it, types of lighting systems – Direct, semi direct, indirect, semi indirect, general diffused & mixed diffused & their differentiation w.r.t. luminous efficiency, softness of light, application, reflector, reflector cum diffuse & diffusers used for each lighting system, types of lighting scheme – general, local & localized, their differentiation.

UNIT 2 – MEASUREMENT OF LIGHT

Definition of terms related to light & its unit of measurement – Luminous flux, Lumens, Luminous intensity, candle power, illumination level, or Illuminance, luminance or brightness, types of candle powers – M.S.C.P., M.H.C.P., , efficacy of lamps, Laws of illumination – Inverse Square Law & Lambert Cosine Law.

POLAR CURVES – Significance of Polar curve, types of Polar curves, Methods of drawing Polar curve – calculation of illumination level & brightness for different types of lighting sources, such as Round source, flat source or tubular source/diffuser.

Concept of DLOR, ULOR, LOR, LFF, UFF, LFU, UFU, COU.

UNIT 3 – DESIGN OF INTERIOR LIGHTING

Definition of various factors related to interior lighting design such as maintenance factor, depreciation factor, their selection & range of nominal values. Room Index, Cavity Index, mounting height, suspension height, spacing between two luminaires, criteria to be used for selection of spacing. Space to mounting height ratio. Nominal range of values of space to mounting height ratio, room index & cavity index, factors affecting coefficient of utilization & space to mounting height ratio.

Selection of lamps & luminaires, 7 their methods of mounting, efficacy of lamps/lighting sources & their range of their nominal values.

Steps in Interior lighting design using Lamp Lumen method, preparation of layout of luminaires.

UNIT 4 – OUTDOOR LIGHTING

(a) Street lighting:

Need and criteria for good street lighting, terms related such as carriageway, kerb, outreach, overhang, dual carriage way. Silhouetting effect, types of luminaires used their advantages and disadvantages, condition for their usage.

Arrangements of Luminaires: - their advantages & disadvantages, Selection of mounting heights of luminaires, steps in street lighting design, using point by point calculation, method & Polar curves diagram.

(B) Flood Lighting:

Essential features of flood lighting, Terms related to flood lighting, location of flood Light projector, luminaires used for flood lighting selection of flood light projectors. Calculation of space to mounting height ratio. Definition of beam spread, beam factor & waste light factor & their range of nominal value. Aiming of flood light projectors. Steps in design of flood lighting.

UNIT 5 – OTHER LIGHTING SYSTEMS

Special Features of:

Entrance, corridor & staircase lighting, Hospital lighting(Hospital ward lighting, operation theatres lighting), sports lighting,. Auditorium lighting & Spot lighting.

4. DEMONSTRATIONS (ANY 5)

1. Identification of following lamps & study their characteristics, such as operating voltage, efficacy, starting time, restarting time, colour appearance, colour rendering effect, effect of voltage variation on their performance.(a)Incandescent (b) Fluorescent tube, (c) L.P.M.V. lamps, (d) H.P.M.V. Lamp, (e) H.P.S.V.Lamp, (f) Mixed light lamp, (g) CFL.
2. Determine reflection & absorptions factors of various surfaces as polished mirrors, plane glass, frosted glass, opal, polysterene, acrylic sheets.
3. .Plotting of polar curves & determination of light output ratio.
4. To study auditorium lighting
5. To study indoor stadium lighting
6. To study airport lighting

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction To Light	10	12
2	Measurement Of Light	10	15
3	Design Of Interior Lighting	12	18
4	Outdoor Lighting	10	24
5	Other Lighting Systems	6	6
TOTAL		48	75

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Cayless & Marsden	Lamps & Lighting	
2	D.C.Prichard	Lighting	
3			

(EE613) TESTING & MAINTENANCE OF ELECTRICAL MACHINES

1. RATIONALE

This subject enables the student to understand the various types of tests to be conducted on the DC & AC electrical machines such as transformer, Induction motor, synchronous machines and other AC motors. The students would get acquainted with the knowledge and exact procedure of carrying out these tests and also get familiarized with the various types of storage and maintenance of these machines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
EE613 Testing & Maintenance Of Electrical Machines	3	-	2	5	75	25	25	25(o)	150

Minimum passing % :Theory 40% Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

UNIT1 : CLASSIFICATION OF TESTS

Type test, routine test, acceptance test, pre-commissioning/ commissioning test. Methods of measurement of temp rise of various parts of machines, concept of direct, indirect and regenerative testing (phantom loading) their advantages and disadvantages.

UNIT 2 – DC MACHINE TESTING (No Numericals)

Classification of various losses in DC machines as per IS and the separation of various losses, Definition of mechanical, electrical and overall efficiency. Methods of determining efficiency by brake test, Swinburne test and Hopkinson test.

UNIT 3 – TRANSFORMER TESTING

Tests and their importance on transformer - Phasing out test, ratio and polarity test. M Measurement of winding resistances, insulation resistance test. Measurement of no load losses and no load current, S.C. test and measurement of load losses. Temperature rise tests:- a) Direct load test, b) Back to back test/ Sumpner’s test, c) Short circuit test. Methods of measurement of temperature rise and permissible temperature rise as per IS. Calculation of parameters of equivalent circuit, efficiency and regulation using data from

various tests. High voltage and impulse voltage withstand test, acceptance test

UNIT 4 – INDUCTION MOTOR TESTING

Various types of losses in motor, calculation of rotor input power, rotor output power, mechanical power developed and motor output. Classification of tests:-Type test, routine test and special test as per IS 325-1970. Load test, measurement of temperature of various parts of induction motor (temperature rise test), insulation resistance test and high voltage test, acceptance test.

UNIT 5 – TESTING OF SYNCHRONOUS MACHINES (NO NUMERICAL)

Classification of losses, and computation of efficiency from losses as per IS 4389-1968.

UNIT 6 TESTING AND MAINTENANCE SCHEDULE

Storage, testing and maintenance schedule for transformer and induction machine as per I.S. Care of electrical equipment during period of inactivity and storage. Pre-commissioning testing and maintenance, installation. Maintenance schedule for transformer and induction machine as per IS. Revarnishing process of winding of electrical equipment - Vacuum impregnation, dip impregnation and coating. Causes of failure, its frequency of occurrence and trouble shooting in transformers. Causes of failure, its frequency of occurrence and trouble shooting in induction machines.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Classification Of Tests	4	6
2	Dc Machine Testing	8	12
3	Transformer Testing	10	18
4	Induction Motor Testing	12	18
5	Testing Of Synchronous Machines	4	6
5	Testing And Maintenance Schedule	10	16
TOTAL		48	75

5. List of Experiments: Any 8-10

1. To perform brake test on D.C.shunt motor & calculation of its efficiency.
2. To perform Swinburn's test on D.C. shunt motor, calculation of the various losses and determination of its efficiency as motor and generator.
3. To perform Hopkinson's test on D.C machines and calculation of its efficiency.
4. To perform back to back test on a transformer, to determine the losses and calculation of efficiency as well as regulation.
5. To perform vector group test on three phase transformer.
6. To perform reduced voltage running up test on a three phase induction motor at various loads such as (1) No load ,(2) ¼ of full load ,(3) ½ full load.
7. To perform continuity test and insulation resistance test on windings of three phase induction motor.
8. To perform temperature rise test in a three induction motor.
9. To perform direct load test to determine efficiency of an alternator.
10. To perform temperature rise test in transformer by (a) Winding resistance measurement (by using multimeter), (b) thermometer.
11. Field visit.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	S.Rao	Testing, commissioning, operation and maintenance of electrical equipment	Khanna Publishers
2	S.K. Bhattacharya	Electrical Machines	Tata Mc graw
3	B.V.S Rao	Operation And Maintenance Of Electrical Equipment	Khanna Publishers
4	S.K.Sharotri	Preventive Maintenance Of Electrical Equipments	
5	M.V.Deshpande	Design & Testing Of Electrical Machines	
6			
7.			

(EN616) INDUSTRIAL AUTOMATION

1. Rationale:

Programmable Logic Controller (PLC) system used in automation industries for application such as pick and place, welding, spray painting, cutting, drilling, transportation of the objects etc.

This course deals with the hardware, programming techniques, troubleshooting as well as applications of PLCs

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
EN616 Industrial Automation	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

Minimum passing %: theory 40%,

Duration of the theory papers: 3 hours

L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,

3. DETAILED COURSE CONTENT

chapter	Name of the Topic	Hou rs	Mark s
1	Basics of automation 1.1 Need of automation 1.2 Benefits of automation 1.3 Application areas – Process industries, Buildings, Robotics, Infrastructure, Aerospace, railways, Automobiles, Telecom, Electrical distribution, Medical	04	05
2	PLC Basics 2.1 Evolution and Role of PLC in Automation 2.2 Block Diagram & Principle of Working 2.3 PLC Classification based on Type and Size 2.4 PLC Characteristics – CPU, Racks, Power Supply, Memory, Input & Output Modules, Application Specific Modules, Speed of Execution, Communication, Redundancy.	08	15
3	PLC Hardware 3.1 Description and Function of various PLC Modules 3.2 PLC Hardware Configuration 3.2.1 Addressing of PLC I/O 3.2.3 Diagnostic Features	06	10
4	PLC Programming languages 4.1.1 Introduction to PLC Programming Languages – Ladder, Instruction List, Structured Text, IEC 1131-3	04	08
5	Instruction set I/O addressing of PLC. Relay type instructions - NO, NC, One shot, Latch, and Unlatch. Timer instructions - On delay timer, off delay timer, Retentive timer, and Timer reset. Counter instructions - up counter, down counter, high speed counter, counter reset. Comparison instructions – Equal, Not equal, Greater, Greater than equal, Less, Less than equal. Logical instructions – AND, OR, EX-OR, NOT.	08	12

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6	<p>Basic Programming Simple programming examples using ladder programming language based on relay, timer, counter, logical instruction</p>	06	08
7	<p>PLC Applications</p> <p style="padding-left: 40px;">5.1 Control of pneumatic cylinder</p> <p style="padding-left: 40px;">Logical control with and without latching, logical control with time response, sequence control</p> <p style="padding-left: 40px;">5.2 conveyor control</p> <p style="padding-left: 40px;">5.3 elevator control</p> <p style="padding-left: 40px;">5.4 bottle filling control</p> <p style="padding-left: 40px;">5.5 temperature control</p>	10	12
8	<p>Installation and troubleshooting PLC installation- enclosures, rack, master control relay, grounding, noise suppression, maintenance guidelines.</p> <p>PLC troubleshooting- input and output troubleshooting using module LED status, troubleshooting of ladder program.</p>	04	5
Total		48	75

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS
(THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	Theory Marks Distribution for End Semester Exam <i>(Duration – 3 Hours)</i>
1.	Basics of automation	04	05
2.	PLC Basics	08	15
3.	PLC Hardware	06	10
4.	PLC Programming languages	04	08
5.	Instruction set	08	12
6.	Basic Programming	06	08
7.	PLC Applications	10	12
8.	Installation and troubleshooting	04	5
	<i>Total</i>	48	75

5. List of Practicals:

1. Verify functions of logic gates by using PLC.
2. Ladder program for Start stop logic using two inputs.
3. Ladder program for push to start and push to stop. (Use single Push Button)
4. Ladder program for blinking of LED's
5. Write and verify ladder program for sequential ON-Off control of Lamps.
6. Write and verify ladder program for sequential control of DC motors.
7. Use of Timers for Traffic Control.
8. Use of counters for pulse counting using limit switch/ proximity sensor.
9. Ladder program temperature On-Off control loop using PLC.
10. Ladder program of PLC based application using conveyor system.
11. Ladder program of PLC based application using Elevator system.
12. Ladder program for sequencing of cylinders
13. Ladder program of PLC based application for bottle filling

6. Learning Resources/Books:

Sr. No.	Author	Title	Publisher
1	NIIT	Programmable Logic control- Principles and applications	Prentice Hall India
2	Madhuchand A Mitra & Samarjit Sen Gupta	Programmable logic controllers and Industrial automation	Penram International

(IE6) INSTIUTIONAL ELECTIVE**

1. RATIONALE :

It has been observed that the curriculum prescribed, is many times out of context of Industry, on account of the pace with which technology development is taking place at Industry end. Due to this, gap exists between the Industry requirement of manpower and manpower produced by the Polytechnics. Board takes some time to incorporate the development of technology in the curriculum and many a times technology becomes outdated when it is incorporated in the curriculum. Further the expertise to train students as per Industry current requirement is available at the institute, but the same cannot be taught to students, as it is not a part of curriculum.

To address this situation, Board has decided to permit Institutions affiliated to Board, to identify such technologies or other aspects and teach the same to the students as an elective subject called “Institutional Elective”. Through this Institutional Elective subject, Institutions will be able to cater to the requirements of Industry by identifying their immediate requirement and prepare the students for the requirement by developing the curriculum in consultation with the Industry.

As many a time’s same subject may not be offered more than one or two years, a non conventional way of teaching – learning may be required to be adopted. Participation of Industry experts, guest lecturers, visit to Industry, exploring the knowledge available on net, etc may be essential to achieve the objectives.

2. TEACHING AND EXAMINATION SCHEME :

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory		Practical		Total Marks
	L	T	P	C	TH	TM	PR/OR	TW	
IE6** INSTIUTIONAL ELECTIVE	3	-	2	5	75	25	25	25	150

3. DETAILED COURSE CONTENTS :

- a) Curriculum shall be drafted by the concerned department by interacting with Industry counterpart in regards to the Newer Technology required to be transferred for purpose of Teaching /Learning process.
- b) Department shall work out the modalities of execution of the curriculum at Industry/Institute Level.
- c) Curriculum shall be forwarded to Board for approval before its implementation.