WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT

(A Statutory Body under West Bengal Act XXVI of 2013)
(Technical Education Division)
Karigari Bhavan, 4th Floor, Plot No. B/7, Action Area-III, Newtown, Rajarhat, Kolkata–700 160

WBSCTVESD Curriculum for Diploma Courses in Engineering and Technology

Semester I
(Common to all Branches)

Sl. No	Category of Course	Course Title	Hours per week			Total contact hrs/ week	Credits	Marks
			L	T	P			
1.	Basic Science	Mathematics-I	2	1	0	3	3	100
2.	Basic Science	Applied Physics-I	2	1	0	3	3	100
3.	Basic Science	Applied Chemistry	2	1	0	3	3	100
4.	Humanities & Social Science	Communication Skills in English	2	0	0	2	2	100
5.	Engineering Science	Engineering Graphics	0	0	3	3	1.5	100
6.	Engineering Science	Engineering Workshop Practice	0	0	3	3	1.5	100
7.	Basic Science	Applied Physics-I Lab	0	0	2	2	1	100
8.	Basic Science	Applied Chemistry Lab	0	0	2	2	1	100
9.	Humanities & Social Science	Sports and Yoga	0	0	2	2	1	100
10.	Humanities & Social Science	Communication Skills in English Lab	0	0	2	2	1	100
	Total Credits and Marks						**18**	**1000**

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Syllabus for Engineering Mathematics-I

Course Title:	Engineering Mathematics-I
Course Code:	BS101/M-I
Number of Credits :	3(L: 2+1: T) P: 0
Pre Requisites :	1) Basic Formulae of Algebra, Trigonometry should be known 2) Preliminary knowledge of the vector
Total Contact Hours :	45 hrs.

Aim: Engineering Mathematics is the backbone of engineering students. The curriculum of mathematics has undergone changes from time to time in accordance with the need of engineering branches. The revised syllabus has been designed keeping in view the emerging needs of all categories of students. Great emphasis has been laid on the application of various contents like algebra, complex numbers, vectors, trigonometry and derivative. This course will develop analytical abilities to make exact calculations and provide a continuing educational base for the students.

Course Objectives: After the completion of the course the students will be able to

- apply the basic concepts of logarithm, complex number, quadratic equation and binomial theorem for solving the engineering and practical problems.
- find the solutions of vector oriented problems like work done, moment etc by applying vector algebra.
- simplify trigonometric expressions and solve trigonometric equations which will be useful in solving the scientific problems.
- analyze limit, continuity, derivatives of different functions and physical interpretation of derivatives which will be applicable in real situation.

Course Content

Unit-1

Algebra

1.1 Logarithm: 3 Hours

1.1.1 Definition of natural and common logarithm.

1.1.2 General Properties of logarithm and simple problems

1.2 Complex Numbers: 5 Hours

1.2.1 Definition of Complex numbers, Real and Imaginary parts of a complex number, Equality of two complex numbers, Conjugate of a complex number

1.2.2 Modulus and Argument of a complex number and simple problems

1.2.3 Polar and Cartesian forms of a complex number and their relation.

1.2.4 Algebraic operations (Addition, Subtraction, multiplication, Division) of complex numbers

1.2.5 De Moivre's Theorem (without proof) and simple problems.

1.2.6 Cube roots of unity and their properties with problems.

1.3 Quadratic Equations: 4 Hours

1.3.1 Definition of Quadratic Equations.

1.3.2 Finding the roots of a quadratic equation, conjugate roots& simple problems

1.3.3 Nature of the roots using discriminant & problems

1.3.4 Relation between roots and co-efficients & problems

1.3.5 Formation of quadratic equations if roots are given.

1.4 Binomial Theorem: 4 Hours

1.4.1 Definition of factorial of a number, permutation(n_{P_r})& combination (n_{C_r}) with formula only

1.4.2 Binomial Theorem (without proof) for any index, simple problems on positive index only

1.4.3 General Term and Middle Term and problems

1.4.4 Expansion of$(1+x)^{-1}, (1-x)^{-1}, where\ |x|<1$, exponential & logarithmic series only (no problem)

Unit-2

Vector Algebra 7 Hours

2.1 Definition of vector and types of vectors

2.2 Concept of a position vector and Ratio formula& simple problems

2.3 Rectangular resolution of a vector

2.4 Equality, addition, subtraction of vectors and multiplication of a vector by a scalar

2.5 Scalar (dot) and Vector (cross) product of two vectors with properties & simple problems

2.6 Application of dot product -- work done by a force, projection of a vector upon another

2.7 Application of cross product -- finding area of a triangle and parallelogram, moment of a force

Unit-3

Trigonometry 10 Hours

3.1 Concept of trigonometrical angles, measurement of angles in degree, radian and grade & their relation only.

3.2 Trigonometrical ratios of angles, associated angles, Trigonometric ratios of some standard angles, problems

3.3 Compound angles formula (without proof), multiple, sub-multiple angles & simple problems

3.4 Solutions of Trigonometrical Equations, simple problems (angle lies between 0 and 2π)

3.5 Inverse Circular Function & simple problems

3.6 Properties of triangle, basic formulae only

Unit-4

Function, Limit & Continuity, Derivative

4.1 **Function** 2 Hours

4.1.1 Definition of variables & constants

4.1.2 Definition of function with examples, domain and range of a function

4.1.3 Types of functions (even-odd, increasing-decreasing, inverse, periodic) with simple examples

4.1.4 Graph of trigonometric functions, sin x, cos x, tan x only

4.2 **Limit & Continuity** 2 Hours

4.2.1 Definition of limit (with left hand limit & right hand limit), Fundamental Theorem on limit (only statement), standard limits and simple problems

4.2.2 Continuity of functions, elementary test for continuity of functions (finite limit)

4.3 **Derivative** 8 Hours

4.3.1 Definition of derivatives

4.3.2 Derivatives of standard functions

4.3.3 Rules of differentiation of sum, difference, product and quotient of functions.

4.3.4 Derivatives of composite functions (Chain Rule)

4.3.5 Derivatives of inverse circular functions, implicit functions and logarithmic differentiation

4.3.6 Derivative of parametric functions, derivative of a function with respect to another function

4.3.7 Second order derivatives with simple problems

4.3.8 Application of derivatives –Physical & Geometrical interpretation of derivative, checking increasing-decreasing functions, finding velocity & acceleration, Maxima-Minima of function of single variable with simple problems.

Examination Scheme:

A. Semester Examination pattern of 60 marks:

1. Objective questions- 20 marks (1 mark each question), (At least 5 question from each **group**)
2. Subjective questions- 40 marks (at least 2 questions of 10 marks from each **group**)

- **Group- A** contains Unit-1 & Unit-2 (At least 40 marks); **Group-B** contains Unit-3 (At least 20 marks); **Group-C** contains Unit-4(At least 20 marks)

N.B.- Student will answer objective type questions of 20 marks and for subjective question of 40 marks, taking at least one question from each **group** of the above three **groups**.

B. For the internal Assessment 40 marks:

1. Class Test Examination/Internal Examination; 20 marks; choose best two out of three Class Test Examinations/ Internal Examinations
2. Class Attendance; 10 marks
3. Viva/ Quiz/Presentation/Assignment/Project/Report etc.; 10 marks

Text Books & Reference -

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Konch & Dey, Bhagabati Publication
3. Engineering Mathematics, Babu Ram, Pearson
4. Trigonometry, S.L.Loney, S.Chand & Co.
5. Higher Algebra, H. S. Hall & Knight, Book Palace, New Delhi
6. Advanced Engineering Mathematics, E. Kreyszig, Wiley
7. Engineering Mathematics, A. Sarkar, Naba Publication
8. Diploma Engineering Mathematics, B. K. Paul, U.N.Dhar & Sons
9. Analytic Geometry Two & Three Dimensional and **Vector Analysis**, R. M. Khan, New Central Book Agency
10. Higher Algebra: Classical, S.K. Mapa, Sarat Book House
11. Introduction to Real Analysis, S.K. Mapa, Sarat Book House
12. Engineering Mathematics, Reena Garg, Khanna Publishing House, New Delhi
13. Calculus and Analytic Geometry, G. B. Thomas, R. L. Finney, Addison Wesley
14. Engineering Mathematics, V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Vikas Publishing House.
15. Advanced Engineering Mathematics, Reena Garg & Chandrika Prasad, Khanna Publishing House, New Delhi
16. Web portal: https://www.ndl.gov.in/homestudy/science
    https://ncertbooks.ncert.gov.in/login
    https://epathshala.nic.in//
    https://webscte.co.in/
    https://en.wikipedia.org/wiki/
    https://openlibrary.org/
    https://www.youtube.com/
    http://content.inflibnet.ac.in/
    https://doabooks.org/
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Applied Physics for Sem-I (Theory)

Reviewed and prepared by Syllabus-Sub-committee, on the basis of recommendation of AICTE

Sem –I (Theory)

Course Code	:	BS103
Course Title	:	Applied Physics-I
Number of credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	High School Level Physics
Course Category	:	BS

Course Content:

Unit 1: Physical world, Units and Measurements

Physical quantities; fundamental and derived, Units and systems of units (CGS and SI units),

Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis.

Measurements: Need, measuring instruments, least count, types of Measurement (direct, indirect), Errors in Measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.

Unit 2: Force and Motion

Force, Momentum, Conservation of linear momentum, its applications such as recoil of gun, numerical problems rockets (concept only), Impulse and impulsive force.

Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period, relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical), concept of Centripetal and centrifugal forces with examples (No derivation, only formula) banking of roads and bending of cyclist,concept and formula and numerical problems.

Unit 3: Work, Power and Energy

Work: Concept and units, examples of zero work, positive and negative work

Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on rough inclined plane.

Energy and its units, kinetic energy and potential energy, Conservation of mechanical energy for freely falling bodies(simple numerical problems), transformation of energy (examples only).

Power and its units, power and work relationship, calculation of power (numerical problems).

Unit 4: Rotational Motion

Translational and rotational motion with examples, Definition of torque and angular momentum and their relation, Conservation of angular momentum (quantitative) and its applications.

Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only). Simple numerical problems.

Unit 5: properties of Matter

Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve.

Surface tension: Concept, units, cohesiv**e and adhesive forces**, angle of contact, Capillary rise (formula only), applications of surface tension, effect of temperature and impurity on surface tension.

Viscosity and coefficient of viscosity: terminal velocity, Stoke's law and effect of temperature on viscosity.

Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynol**d**'s number Equation of continuity, Bernoulli's Theorem (only formula and numericals) and its applications (mention name only).

Unit 6: Heat and Thermometry

Concept of heat and temperature, basic concepts of measurements of heat and temperature, modes of heats transfer (conduction, convection and radiation with examples), Co-efficient of thermal conductivity simple numerical problems.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions of solids and relation amongst them, specific heats Cp & Cv of a gas and their relationship (Mention only).

References:

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi
6. Comprehensive Practical Physics, Vol,I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
7. Practical Physics by C.L. Arora, S. Chand Publication.
8. Comprehensive Physics Vol,I & II.

Applied Physics for Sem-I (Lab)

Course Code	:	BS107
Course Tittle	:	Applied Physics-I Labs
Numbers of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	NIL
Course Category	:	BS

Course Objectives:

Study of Applied Physics aims to give an understanding of physical world by observations and predictions. Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

List of Practical's/Activities(To perform minimum 8 practical's).

1. To measure the volume of the material of a given hollow cylinder, using a Vernier calipers.
2. To determine the area of cross section of a thin wire using a screw gauge.
3. To determine radius of curvature of a convex and a concave mirror/ surface using a spherometer.
4. To find the co-efficient of friction between wood and glass using a horizontal board.
5. To determine force constant of a spring using Hook's law.
6. To find the moment of inertia of a flywheel.
7. To find the viscosity of a given liquid (Glycerin) by Stoke's law
8. To find the co-efficient of linear expansion of the material of a rod.
9. To **verify** Boyle's law.
10. To determine the relative density of sand by using a sp. gr. Bottle.

Reference books:

1. Text books of Physics for Class-XI & XII (Part-I & II); N.C.E.R.T., Delhi.
2. Comprehensive Practical Physics, Vol-I & II, JN Laxmi Publications (P) Ltd.,
3. Practical Physics by C.L. Arora, S. Chand Publication.

Applied Chemistry

Course Code	:	BS105
Course Title	:	Applied Chemistry
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	High School Level Chemistry
Course Category	:	BS

Course Objectives:

There are numerous number materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyse and properties of natural raw materials require for producing economical and eco-friendly finished products.

- Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
- Use relevant water treatment method to solve domestic and industrial problems.
- Solve the engineering problems using knowledge of engineering materials and properties.
- Use relevant fuel and lubricants for domestic and industrial applications
- Solve the engineering problems using concept of Electrochemistry and corrosion.

Instruction on question setting:

- Question paper contains three groups A, B and C. Unit 1 and unit 2 are included in group A, unit 3 and unit 4 in group B, unit 5 in group C.
- 20 (twenty) number of questions are of objective types consisting of all groups, each carrying 1 (one) mark.
- 5 (five) questions are to be answered taking at least one from each group (each question carries 8 marks).

Course Content:

- **Unit 1: Atomic Structure, Chemical Bonding and Solutions**

  Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertainty principle, Quantum numbers - orbital concept. Shapes of s, p and d orbitals Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration.

  Type of chemical bonding: ionic, covalent, metallic and hydrogen bonds. Example of each type. Hybridization, sp^3, sp^2, sp, example: $BeCl_2$, BF_3, CH_4, NH_3, H_2O; structure of diamond, graphite.
  Solution - idea of solute, solvent and solution, methods to express the concentration of solution-molarity (M = mole per liter), ppm, mass percentage, volume percentage and mole fraction.

- **Unit 2: Water**

  Graphical presentation of water distribution on Earth (pie or bar diagram). Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness.

  Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by ETDA method, total dissolved solids (TDS) alkalinity estimation.

  1) Water softening techniques - soda lime process, zeolite process and ion exchange process.
  2) Municipal water treatment (in brief only) - sedimentation, coagulation, filtration, sterilization.

  Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collect data and understand standards).

- **Unit 3: Engineering Materials**

  Natural occurrence of metals - minerals, ores of iron, aluminium and copper, gangue (matrix), flux, slag, metallurgy - brief account of general principles of metallurgy. Extraction of iron from haematite ore using blast furnace, aluminium from bauxite along with reactions, reactions during copper extraction. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications.

  General chemical composition, composition based applications (elementary idea only details omitted):

  Port land cement and hardening, Glasses Refractory and Composite materials.

  Polymers - monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon - 6, nylon - 66, Bakelite only), rubber and vulcanization of rubber.

- **Unit 4: Chemistry of Fuels and Lubricants**

  Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula.

  Proximate analysis and ultimate analysis of coal solid fuel

  petrol and diesel - fuel rating (octane and cetane numbers),

  Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas.

  Lubrication - function and characteristic properties of good lubricant, classification with examples, lubrication mechanism - hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, could and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.

- **Unit 5: Electro Chemistry**

  Electronic concept of oxidation, reduction and redox reactions.

  Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of electrolysis and simple numerical problems.

  Elementary concept of pH and buffer.

  Industrial Application of Electrolysis –
  - Electrometallurgy
  - Electroplating
  - Electrolytic refining.

  Application of redox reactions in electrochemical cells –
  - Primary cells - dry cell,
  - Secondary cell - commercially used lead storage battery, fuel and Solar cells.

  Introduction to Corrosion of metals –
  - definition, types of corrosion (chemical and electrochemical), H_2 liberation and O_2 absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.

  Internal corrosion preventive measures –
  - Purification, alloying and heat treatment and

  External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic inhibitors.

Suggested Sessional work:

- **Unit 1: Atomic Structure, Chemical Bonding and Solutions**

  Assignments: Writing electronic configuration of elements up to atomic number 30 (Z= 30). Numerical on molarity, ppm, mass percentage, volume percentage and mole fraction of given solution.

  Seminar: 1. Quantum numbers,
  2. Discuss the metallic properties such as malleability, ductility, hardness, high melting point, conductance of heat and electricity, magnetic properties of metals.

  Projects: Model of molecules $BeCl_2$, BF_3, CH_4, NH_3, H_2O

- **Unit 2: Water**

  Assignments: Simple problems on hardness calculation.

  Seminar: 1. Quality and quantity requirement of water in house and industry.
  2. Quality of control measures of effluents (BOD & COD).

  Projects: Collect water samples from different water sources and measure of hardness of water.

- **Unit 3: Engineering Materials**

  Assignments: Preparation of table showing different ores of iron, copper and aluminium metals along with their chemical compositions and classify in to oxide sulphide halide ores.

  Seminar: Discuss the chemical reactions taking place in Blast Furnace in extraction of iron; Reactions occurring during extraction of copper and aluminium metals.

  Projects: Make table showing place of availability of different ores in India and show places on India map.

- **Unit 4: Chemistry of Fuels and Lubricants**

  Assignments: Calculation of HCV and LCV of fuel using fuel composition in Dulong's formula.

  Seminar: Chemical structure of fuel components influence on fuel rating.

  Projects: Mapping of energy recourses in India. Collection of data of various lubricants available in the market.

- **Unit 5: Electro Chemistry**

  Assignments: Simple problems on Faradays laws of electrolysis.

  Seminar: 1. Corrosion rate and units.
  2. Corrosion preventions.

  Projects: Mapping of area in India prone to corrosion. Collection of data of various electrochemical cells batteries used in equipment and devices and available in market. Visit to sites such as Railway station to watch corrosion area in railways and research establishment in and around the institution.

References/Suggested Learning Resources:

(a) Books:

1) Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2) Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3) C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4) S. S. Dara & S.S.Umare, Engineering Chemistry, S. Chand. Publication, New Delhi, New Delhi, 2015.
5) Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6) S. Vairam, Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7) G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. l and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
8) Rajesh Agnihotri, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

(b) Open source software and website address:

1) www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
2) www.visionlearning.com (Atomic structure and chemical bonding)
3) wwwcheml.com (Atomic structure and chemical bonding)
4) https://www.wastewaterelearning.com/elearning/ (Water Treatment)
5) www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
6) www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)
7) www.chemcollective.org (Metals, Alloys)
8) www.wqa.org(Water Treatment)

Applied Chemistry Lab

Course Code	:	BS109
Course Title	:	Applied Chemistry Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	BS

Course Objectives:

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

LIST OF PRACTICALS:

Perform any 12 (twelve) Laboratory Practicals:

Volumetric and Gravimetric analysis.

1. Preparation of standard oxalic acid and standard potassium dichromate solution.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution and phenolphthalein as indicator.
3. Standardization of potassium permanganate solution using standard oxalic acid and determination of percentage of iron present in given Hematite ore by $KMnO_4$ solution
4. a) Standardization of sodium thiosulphate using standard potassium dichromate solution by IODOMETRY.

b) Iodometric estimation of copper in copper pyrite ore.

5. Volumetric estimation of total acid number (TAN) of given oil.
6. Volumetric estimation of
    a. Total hardness of given water sample using standard EDTA solution.
    b. Alkalinity of given water sample using 0.01N sulphuric acid.
7. Proximate analysis of coal
    a. Gravimetric estimation moisture in given coal sample.
    b. Gravimetric estimation ash in given coal sample

Instrumental analysis

8. Determine the conductivity of given water sample.
9. Determination of the Iron content in given cement sample using colorimeter.
10. Determination of viscosity of lubricating oil using Redwood viscometer.
11. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.
12. To verify the first law of electrolysis of copper sulfate using copper electrode.
13. Construction and measurement of emf of electrochemical cell (Daniel cell).
14. To study the effect of dissimilar metal combination on cell emf.
15. To apply thin layer chromatography for separation of mixture of inorganic/organic compounds.
16. Qualitative detection of ARSENIC in a given sample of water (~5 ppm solution of sodium arsenite)
17. Determination of dissolved oxygen in a sample of water.
18. Determination of pH value of unknown solution.

Reference book

VOGELS INORGANIC QUANTITATIVE ANALYSIS.

Members present in Syllabus Committee:

1. **Dr. Ujjval Kumar Bhattacharyya** (convener, lecturer, North Calcutta Polytechnic).
2. **Dr. Gandhi Kumar Kar** (Professor and head of the Dept. of Chemistry, Presidency University, Kolkata)
3. **Dr. Shyamal Kumar Chattopadhyay** (Professor IIEST, Shibpur).
4. **Dr. Mrinal Kanti Bain**, lecturer, Calcutta Technical School.
5. **Dr. Dipankar Maity**, lecturer, Birla Institute of Technology.
6. **Dr. Ranjal Paul**, Sr. Manager, Sun Pharmaceuticals Baroda.
7. **Prolay Roy,** lecturer, Memari Government Polytechnic.

Syllabus of Communication Skills in English

{The syllabus for the subject has been prepared by the Syllabus Sub-committee for the subject "Communication Skills in English" in accordance with the following instructions / directions received from Mr. B. Samanta (WBSCTVESD) vide his mail dated Dec. 6, 2019 at 12.04 PM}:-

"A meeting was held on 31.10.2019 at the Council. In the meeting following decisions were taken by the Council

1. It was decided unanimously to adopt the curriculum structure of the AICTE model syllabus 2019(attached) for all diploma courses of WBSCTVESD.

2. New curriculum structure and syllabus of diploma courses shall be prepared as per AICTE model Syllabus 2019 and implemented from the next academic session i.e. 2020-21 in phase manner.

3. Content of the syllabus of diploma courses shall be customized as per the requirement and as per the advice of the syllabus sub- committee."

Sl. No.	Code No.	Course Title	Hours per week (Total-4)			Semester	Credits
			Lecture	Tutorial	Practical		
1	HS 101	Communication Skills in English	2	0	0	1	2
2	HS105	Communication Skills in English - Lab	0	0	2	1	1
Total number of weeks – 17 (seventeen)							

Preamble:

Engineering is a service, and therefore it exists to meet human needs. Needs are communicated through language. No engineer, no matter how brilliant, can do a good job if she or he does not know what the job is for, who they are serving, for what purpose, and what needs to be done to render this service. Feedback also has to be communicated in language: figures are not enough without explanation. Communication, spoken or written, is thus essential for any service provider to do their job.

However, in most cases the courses and syllabi offered to STEM undergraduates do not adequately address the need to make them good communicators. It is often assumed that this question has been addressed by schooling, or they attempt to adapt liberal arts courses to the needs of STEM workers, thereby failing to address those needs. In a country such as India where language learning in general and English learning in particular tend to be neglected or mis-taught, this problem is compounded. To be successful, communicative language learning has to be a two way process, with communication between the teacher and student, and between students. However, the culture of student passivity in the classroom which prevails in India is poor soil for these skills to take root.

We have therefore attempted in this course to produce a system that allows, (within the known constraints) even in a limited form, for project work and conversations, collaboration and role-play, to mitigate the 'keep quiet' culture of the Indian classroom and to encourage young people to find their voices. Polytechnic, College and university students are just one small step away from becoming young professionals, and once they take that step their livelihoods (and also the safety and happiness of their clients) will depend upon how well they can ask and answer questions in the real world.

Without adequate practice, confidence-building and positive reinforcement, the practice of teaching them the pedantic small points of the rules of English grammar, or obsessing over their pronunciation, only serves to silence them further. What they need is an environment where they can communicate with each other and then troubleshoot the results, go over bad communication and make it better, identify their mistakes and correct them without being terrorised by cultural stereotypes. Graduate education should be a safe space for them to do this before work in the real world attaches real penalties to the results of bad communication. With this syllabus and attached guidelines, we have tried to take a small step in the right direction.

Course Title: **Communication Skills in English**

Course Code No.: **HS101**

Hours per week: **02 (Lecture), Total contact hours / week: 02**

Credits: **02**

Course Objectives (AICTE): Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus the main objectives of this course are:

- To develop confidence in speaking English with correct pronunciation
- To develop communication skills of the students i.e. listening, speaking, reading and writing skills
- To introduce the need for personality development – Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc.

Course Content (Theory)
Unit – 1 Communiucation: Theory and Practice

- Basics of communication: Introduction, meaning and definition, process of communication etc.
- Types of communication: formal and informal, verbal, non-verbal and written. Barriers to effective communication
- 7 Cs for effective communication (considerate, concrete, concise, clear, complete, correct, courteous).
- Art of Effective communication,

- Choosing words
- Voice
- Modulation
- Clarity
- Time
- Simplification of words

- Technical Communication

Unit – 2 Soft Skills for Professional Excellence

- Introduction: Soft Skills and Hard Skills.
- Importance of Soft Skills.
- Life skills: Self-awareness and Self-analysis, adaptability, social skills, emotional intelligence, Interpersonal relationship and empathy etc.
- Applying soft skills across cultures – Corporate work culture, Work persona, Professionalism, Time Management
- Case Studies

Unit – 3: Reading Comprehension

Note Taking, Comprehension, vocabulary enhancement and grammar exercises based on reading of texts.

Unit – 4: Professional Writing

The art of writing Report and Memo
CVs
Letters: Job Application and Business
Drafting e-mail, minutes of a meeting, etc

Unit – 5: Vocabulary and Grammar

Remedial Grammar and Exercises
Professional Workplace Communication
Parts of speech, active and passive voice, tenses etc.

Course outcomes (AICTE):
At the end of this course, the participants will:

- Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
- Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.
- Also develop skills of group presentation and communication in team.
- Develop non-verbal communication such as proper use of body language and gestures

Course Title: **Communication Skills in English - Lab**

Course Code No.: **HS105**

Hours per week: **02 (Practical), Total contact hours / week: 02**

Credits: **01**

Course Objectives (AICTE):

Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus the main objectives of this course are:

1. To develop listening skills for enhancing communication.
2. To develop speaking skills with a focus on correct pronunciation and fluency.
3. To introduce the need for Personality development – Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills, etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

Course Content:

Unit – 1:
Basic Common Communication Problems and their Solutions

Unit – 2:
Introduction to Phonetics
Sounds: consonant, vowel. Transcription of words (IPA), weak forms etc.

Unit – 3:
Speaking and Listening Skills
Standard and Formal Speech: Oral presentations, Group Discussions, Public Speaking, Business presentations etc. Conversation practice and role playing, Job interviews, Note taking etc.

Unit – 4:
Non-verbal Communication
Proxemics, Haptics and Kinesics

Members of the Syllabus Sub-committee for ***Communication Skills in English:-***

1. Prof. Rimi B. Chatterjee (Expert),
   Professor, Department of English, Jadavpur University and former Professor of English at IIT, Kharagpur, West Bengal.
   (Prof. Chatterjee, the subject expert, has wide ranging experience in teaching Communication Skills in English to Engineering students, both in IIT, Kanpur and Jadavpur University).
2. Ms. Purna Biswas (Member), Lecturer in Humanities, EIJE, Dalalpukur, Howrah
3. Mr. Santanu Mitra (Member), Lecturer in Humanities, Women's Polytechnic, Kolkata
4. Mr. Hemadri Chatterjee (Convener), Lecturer in Humanities, Ramakrishna Mission Shilpapitha, Belgharia, Kolkata

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Proposed Syllabus for Engineering Graphics

Name of the Course :	**Engineering Graphics**
Course Code :	Semester : First
Duration : 17 Weeks	Maximum Marks : : 100
Lecture : Nil	Assignment : 20
	Class Performance : 20
Tutorial : Nil	Viva Voce : 10
	Attendance : 10
Practical : 3 hrs./week	External (Viva, Sketch Book & Drawing Sheet) : 40
Credit : 1.5	

Aim :

1. The Course is aimed to develop the basic graphic skills so that the students can prepare Engineering Drawing in their practical field.
2. Understand the fundamentals of Engineering Graphics.
3. Read and interpret object drawing.
4. To develop the skills of Computer Aided Drafting and can easily cope up the skill of drafting for modern drawing offices/industries.

Objectives :

1. To develop sense of Scale and drawing technique of different curves and their application.
2. To develop drafting and sketching skills, to know the applications of drawing equipment and get familiarize with Indian Standards related to engineering drawing.
3. To develop concept of Orthographic Projection and to draw Orthographic Views for different objects.
4. To visualize three dimensional objects from Orthographic Views and to draw isometric views/projections.
5. To be familiar with AutoCAD and to develop the skill of drafting in AutoCAD by using different commands.

Pre-requisites :

1. Unambiguous and clear visualization.
2. Sound Pictorial Intelligence.

Unit No.	Contents
Unit 1	1.1 Letters and numerals (Single Stroke Vertical) 1.2 Conventions of lines and their applications 1.3 Concept of Representative Fraction (R.F), Reduced scale, Enlarged scale & Full Scale, Engineering Scale such as Plain Scale & Diagonal Scale. 1.4 Dimensional Techniques - Unidirectional System and Aligned System.
Unit 2	2.1 Geometrical Construction : a)Draw Regular Polygons, Ellipse, Parabola, hyperbola b) Draw Curve passing through given no. of points, cycloid, involute of a circle and polygon
Unit 3	3.1 Introduction to Orthographic Projection : Concept of First Angle & Third Angle of projection. Projections of lines(limited to both ends in 1st quadrant) : parallel to the reference planes, inclined to the reference planes (1^{st} Angle Method) 3.2 Projections of solid body: Regular Polygonal Pyramid, Cylinder, Cone - inclined to only one reference plane (1^{st} Angle Method)

Unit 4	4.1 Conversion of Pictorial Views into orthographic views (Simple Objects &First Angle Projection Method Only)
Unit 5	5.1 Introduction to Isometric Projections, Concept of Isometric Scale and Isometric Views 5.2 Conversion of Orthographic views into Isometric Views/Projections : Simple Objects e.g. regular prism, pyramid, cone, cylinder.
Unit 6	6.1 Free hand sketches of engineering elements such as thread profile, nuts, bolts, studs, set screws, washers, locking arrangements etc. and their conventional representation (For branches other than Mechanical Engineering, the teachers should select branch specific elements for free hand sketching)
Unit 7	7.1 Introduction to different commands and toolbars of AutoCAD a) Draw command : Lines, Circle, Polygon, Arc, Ellipse, Polyline, Fillet, Chamfer, Hatch, Array (Rectangular & Polar) etc. b) Modify Command : Offset, Trim, Extend, Erase, Fillet, Chamfer, Break, Lengthen, Copy, Move, Mirror, Stretch, Match Properties, Pedit etc. c) View : Zoom All, Zoom Window, Zoom Extent etc. d) Dimensioning : Dimension Setting, Linear, Aligned, Radial, Diameter, Leader, Angular etc. c) Text : Text Style, Dtext, Mtext, DDedit etc. d) Format : Limits, Layers, Pan etc. 7.2 Making a few simple 2D drawings in AutoCAD.

Sl. No.	Practical Exercise	Unit No.	Hrs.
1	Draw horizontal, vertical, 30˚, 45˚, 60˚, 75˚, different types of lines, dimensioning styles using Tee and Set Squares / Drafters. (Do this exercise in Sketch Book)	1	02
2	Write single stroke vertical alphabets and numerical (7:4 ratio) (Do this exercise in Sketch Book)	1	02
3	Draw regular geometric constructions and redraw/copy the given figure (Do this exercise in Sketch Book)	1	02
4	Draw at least two problems on plain scale and two problems on diagonal scales (Do this exercise in Sketch Book)	1	03
5	Draw problems on ellipse, parabola, involute and cycloid (Do this exercise in Sketch Book)	2	06
6	Draw at least two problems on lines and two problems on solid (First Angle Projection method) (Do this exercise in A2 size drawing sheet)	3	09
7	Plan, Elevation and Side View of at least two pictorial views to be drawn on one A2 size Drawing Sheet along with dimensions	4	06
8	At least Two Isometric Views and two Isometric Projections to be drawn on one A2 size Drawing Sheet	5	06

9	Draw free hand sketches / conventional representation of machine elements such as thread profile, nuts, bolts, studs, set screws, washers, locking arrangements etc.	6	03
10	Simple geometrical figures such as triangle, rectangle, polygon, circle, ellipse, and simple orthographic views of brackets, gaskets etc. to be drawn in AutoCAD and Printout to be taken on A4 size Sheet. At least two sheets to be prepared.	7	12
	Total Period		51

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
N.D.Bhatt	Engineering Drawing	53rd Edition	Charotkar Publishing House
R.K.Dhawan	Engineering Drawing	Revised Edition 2015	S.Chand & Co.
K. Venugopal & V. Prabhuraja Raja	Engineering Drawing and Graphics + AutoCAD		New Age Publication

Reference Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
S.N. Lal	Engineering Drawing		CENGAGE
Basant Agrawal & C M Agrwal	Engineering Drawing		Tata McGrew Hill
Dhananjay A Jolhe	Engineering Drawing with an Introduction to AutoCAD		Tata McGrew Hill
S.P.Dey	AutoCAD 2014		Vikas Publisher
P.S. Gill	Engineering Drawing		S.K.Kataria & Sons.

References :

1.Engineering Graphics Syllabus of AICTE Model Curriculum 2019.

2. Syllabus of Technical Drawing (Old) of W.B.S.C.T.E

Engineering Workshop Practice

Course Code	:	
Course Title	:	Engineering Workshop Practice
Number of Credits	:	3(L-0, T-0, P-3)
Prerequisites	:	
Course Category	:	Engineering Science
Semester	:	First

COMPETENCY

The Engineering Workshop Practice Course should be taught and implemented with the aim to develop the following Course Outcomes (COs) so that the students will be able to prepare simple jobs on the shop floor of the engineering workshop.

COURSE OUTCOMES

The theory and practical experiences associated with the course, the students will gain the following industry oriented COs:

- Read and interpret job drawings
- Select tools, equipment and machineries according to the job.
- Use the hand tools in different shops for performing different operations
- Prepare the job according to drawing
- Adopt safe working practice.
- Maintenance of workshop tools, equipment and machineries.
- Acquaint with the specifications on all raw materials, tools and equipments used.

COURSE CONTENT

Course Content: There are 9 (nine) modules out of which 6 modules should be taught. Selection of these six modules should be in the following manner.
Module 1, 2 and 3 are compulsory and any three from rest as deemed fit for the branch and availability in the institute.

Module No. & Name	Details of Workshop Content	Hours
1. Electrical Wiring	**1. Introductory Session** • Safety precautions to be followed in Electrical Works • Electric shock, methods of shock treatment • Safety measure: Earthing, Fuse, circuit breakers, etc. • Different types of wire-gauge & strands and their applications • Different tools used in Electrical wiring works • General wiring accessories & their uses.	

	• Types of switches and their application. • Types of wiring and joints. **Practical (any three)- Group works** 1. Study/ demonstration of single phase electrical service connection from pole to house including consumer installation. 2. Study of different types of wiring and connection of Single Phase Motor (Fan). 3. Circuits for one lamp controlled by one switch by surface conduit wiring, 4. Lamp circuits- connection of lamp and socket by separate switches, Connection of Fluorescent lamp/tube light, 5. Simple lamp circuits- install bedroom lighting 6. Simple lamp circuits- install stair case wiring. 7. Wiring of calling-bell	10 hrs
2. Fitting	**1. Introductory Session** • Demonstration of different tools and equipment used in fitting shop. • Study of different precious measuring instrument such as micrometer, vernier calipers, bevel protectors. • Care and maintenance of the above mentioned tools and equipment. • Study of drilling machines and power tools used in fitting shop. • Safety measure to be followed in Fitting shop. **2. Practical/ Demonstration** • Demonstration of different fitting job operations like chipping, filing, drilling, tapping, sawing, cutting etc. **Job Preparation -Individual Works** • One simple fitting job involving practice of chipping, filing, marking, drilling, tapping, cuttingetc.	10 hrs
3. Welding	**1. Introductory Session** • Purpose of welding, advantages & disadvantages of it over other joining processes. • Types of welding processes (in brief) • Specification, usage, care & maintenance of various welding machines, tools & equipment used in the shop. • Selection of welding methods and electrodes. • Safety measures & equipment required while working in welding shop.	10 hrs

	2. Practical/ Demonstration • How to start an Arc & use it for Arc Welding, sustainably. • Demonstration of various welding m/c, tools, equipment available in the shop. • Demonstration of shielded metal arc welding (SMAW), Gas welding and cutting. • Repairing of broken metal structures using welding. • Defects of welding & their remedies. Job Preparation (Any One)-Individual Works Job 1 – Butt Joint Job 2 – Lap Joint Job 3 – 'T' Joint	
4. Carpentry	**1. Introductory Session** • Raw materials used in carpentry shop: wood & alternative materials. • Specification, usage, care & maintenance of various tools, equipment and machineries used in the Carpentry shop. • Types of wood. Difference between hard and soft wood. • Timber: characteristics, usage and defects. Difference between wood and timber. • Seasoning of wood. • Different types of joints such as cross half-lap joint, through tenon and mortise joint, dove tail joints, etc. • Safety measures to be taken in carpentry shop. **2. Practical/Demonstration** • Demonstration of use of different tools, equipment and machineries. • Demonstration of different wood working processes, like plaining, marking, chiseling, grooving, turning of wood etc. Job Preparation -Individual Works One simple job involving any one joint.	10 hrs
5. Sheet Metal Working	**1. Introductory Session** • Briefing on different types of sheet metal, like Stainless Steel Sheet Metal, Copper Sheet Metal, Brass Sheet Metal, Corrugated Sheet Metal, Galvanized Sheet Metals etc., and their uses. • Demonstration of different types of Tools& machines and their use in sheet metal work.	

	• Demonstration of different types sheet metal joints and their applications. • Demonstration of different types of sheet metal working: cold working, hot working, warm working, bending, drawing, end curling, shearing, piercing, sheet metal presses, etc. • Sheet metal joining operation like welding, brazing, soldering and riveting. • Safety measure to be followed in sheet metal work. **2. Practical:** Making of any simple job(example: sheet metal mug) involving different sheet petal operations including soldering and riveting.	10 hrs
6. Smithy/Forging	**1. Introductory Session** • Purpose of Smithy / Forging Works • Different types of Hearths used for Smithy / Forging works • Specification, usage, care and maintenance of various tools and equipment used in the shop. • Types of raw materials used in Smithy / Forging shop & their required temperature for it. • Types of fuel used in hearth and the respective maximum temperature obtained. • Uses of Fire Bricks & Clays in Smithy/Forging Work Shop. • Types of heat treatment processes involved in Smithy / Forging shop and its effect on forged items. • Hot forge & cold forge utility. • Safety measures & equipment required while working in Smithy / Forging Shop **2. Practical/ Demonstration** • Practice / Demonstration of firing of hearth / Furnace, Cleaning of Clinkers and Temperature Control of Fire. • Practice / Demonstration on different basic Smithy / Forging operations such as Upsetting, Drawing down, Setting down, Necking, Cutting, Bending, Fullering, Swaging, Punching and Drifting etc. Demonstration on making of • Cube, hexagonal cube, hexagonal bar from round bar. • Hexagonal /octagonal flat chisel including tempering of edges.	10 hrs

	Job Preparation (Any one) – **group effort** by students • Job 1 Making a cold / hot flat chisel • Job 2 Simple Tong • Job 3 Production of any other utility tools/ items -e.g. Chain-links, door ring, hexagonal bolt / square shank boring tool, fan hook (long S-type) etc.	
7. Machine shop Practice	1. **Introductory Session** • Purpose of a machine shop/ workshop in industry. • Demonstration of all available tools & tackles of machine shop. • Inculcation of basic idea of machine tool; differentiation between machine & machine tool. • Familiarization of all machine tools in the machine shop. • Safety precautions for working in a machine shop. 2. **Practice in Machine Shop** • Identification of different parts of a lathe and utility of those parts. • Demonstration of all possible machining operation on a lathe, e.g. turning, facing, parting, taper turning, drilling, threading etc. • Demonstration to operate a drilling machine or shaping machine and identifying different parts of that m/c tool. Job Practice-(Individual work) Preparation of one job in Lathe, involving simple machining operations (e.g. turning, facing, grooving, threading, knurling etc.).	10 hrs
8. Electronic Shop	**1. Introductory Session** • Discussion on active and passive electronic components. • Discussion on soldering and its use. • Introduction on multi-meter and its use. • Discussion on use of test equipment in fault finding. • Discussion on resistor, capacitor, amplifiers, relay, diodes, zener diode and LEDs. • Safety measure to be followed in electronic shop. **2. Practical/ Demonstration** • Familiarization, identification and testing of active and passive components. • Soldering and de-soldering practice.	10 hrs

	• Use of Multi meter (both Analog and digital). • Demonstration of resistor, capacitor, amplifiers, relay, diodes, zener diode and LEDs.	
9. Demonstration	Following demonstration may be conducted: 1. Demonstration of measurement of Current, Voltage, Power and Energy for an electrical system/ wiring. 2. Demonstration of advanced power tools such as pneumatic tools, electrical portable grinding tools and accessories. 3. Demonstration of bourdon tube pressure gauge. 4. Demonstration of ball bearing and roller bearing. 5. Demonstration of portable power tools for Cutting and drilling, etc.	10 hrs

LEARNING OUTCOMES (LOs)

At the end of the course, the student will be able to:

- Understand the basic safety measure to be followed in different works.
- Understand basic engineering processes for manufacturing and assembly.
- Understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions.
- Understand the various types of wiring systems and acquire skills in electrical wiring.

References

[1] S.K. HazraChaudhary, Workshop Technology, Volume I&II, Media Promoters and Publishers, Mumbai.

[2] B.S. Raghuwanshi, Workshop Technology, Volume I&II, DhanpathRai and Sons, New Delhi 2014

[3] K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014

[4] Kents Mechanical Engineering Hand book, John Wiley and Sons, New York

[5] H.S. Bawa, Workshop Practice, Mcgrawhill HED

[6] R.P. Singh, Electrical Workshop: Safety, Commissioning, Maintenance & Testing of Electrical Equipment, Wiley

Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to group of students for hand-on experiences
- Encouraging students to visit to sites such as Railway station and research establishment around the institution.

Learning Outcomes:

At the end of the course student will be able to

- To express quantitative measurements accurately.
- To practice and adapt good measuring techniques.
- To use various apparatus for precise measurements.
- To understand and differentiate different methods of quantitative analysis.
- To know and understand principles of quantitative analysis using instruments.
- To construct different electrochemical cells used in developing batteries.
- To understand and appreciate methods of corrosion abetments.

Reference Books:

1. Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Dr. G. H. Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
3. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.
4. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.

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Course Code	:	HS103
Course Title	:	Sports and Yoga
Number of Credits	:	1(L:0,T:0,P:2)
Prerequisites	:	NIL
Course Category	:	HS

Course Objectives:

- To make the students understand the importance of sound health and fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
- To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Course Content:

- **Introduction to Physical Education**
  - Meaning & definition of Physical Education
  - Aims & Objectives of Physical Education
  - Changing trends in Physical Education
- **Olympic Movement**
  - Ancient & Modern Olympics (Summer & Winter)
  - Olympic Symbols, Ideals, Objectives & Values
  - Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)
- **Physical Fitness, Wellness & Lifestyle**
  - Meaning & Importance of Physical Fitness & Wellness
  - Components of Physical fitness
  - Components of Health related fitness
  - Components of wellness
  - Preventing Health Threats through Lifestyle Change
  - Concept of Positive Lifestyle
- **Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga**
  - Define Anatomy, Physiology & Its Importance
  - Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
- **Kinesiology, Biomechanics & Sports**
  - Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
  - Newton's Law of Motion & its application in sports.
  - Friction and its effects in Sports.
- **Postures**
  - Meaning and Concept of Postures.
  - Causes of Bad Posture.
  - Advantages & disadvantages of weight training.
  - Concept & advantages of Correct Posture.
  - Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
  - Corrective Measures for Postural Deformities

- **Yoga**
  - Meaning & Importance of Yoga
  - Elements of Yoga
  - Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
  - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
  - Relaxation Techniques for improving concentration - Yog-nidra
- **Yoga & Lifestyle**
  - Asanas as preventive measures.
  - Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
  - Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
  - Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
  - Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
  - Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
- **Training and Planning in Sports**
  - Meaning of Training
  - Warming up and limbering down
  - Skill, Technique & Style
  - Meaning and Objectives of Planning.
  - Tournament – Knock-Out, League/Round Robin & Combination.
- **Psychology & Sports**
  - Definition & Importance of Psychology in Physical Edu. & Sports
  - Define & Differentiate Between Growth & Development
  - Adolescent Problems & Their Management
  - Emotion: Concept, Type & Controlling of emotions
  - Meaning, Concept & Types of Aggressions in Sports.
  - Psychological benefits of exercise.
  - Anxiety & Fear and its effects on Sports Performance.
  - Motivation, its type & techniques.
  - Understanding Stress & Coping Strategies.

- **Doping**
  - Meaning and Concept of Doping
  - Prohibited Substances & Methods
  - Side Effects of Prohibited Substances
- **Sports Medicine**
  - First Aid – Definition, Aims & Objectives.
  - Sports injuries: Classification, Causes & Prevention.
  - Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries
- **Sports / Games**

  Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.
  - History of the Game/Sport.
  - Latest General Rules of the Game/Sport.
  - Specifications of Play Fields and Related Sports Equipment.
  - Important Tournaments and Venues.
  - Sports Personalities.
  - Proper Sports Gear and its Importance.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga By B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

Course Outcomes:

On successful completion of the course the students will be able to:

(i) Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.

(ii) Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.

(iii) Learn breathing exercises and healthy fitness activities

(iv) Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.

(v) Perform yoga movements in various combination and forms.

(vi) Assess current personal fitness levels.

(vii) Identify opportunities for participation in yoga and sports activities.

(viii) Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.

(ix) Improve personal fitness through participation in sports and yogic activities.

(x) Develop understanding of psychological problems associated with the age and lifestyle.

(xi) Demonstrate an understanding of sound nutritional practices as related to health and physical performance.

(xii) Assess yoga activities in terms of fitness value.

(xiii) Identify and apply injury prevention principles related to yoga and physical fitness activities.

(xiv) Understand and correctly apply biomechanical and physiological principles elated to exercise and training.

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Course Code	:	HS105
Course Title	:	Communication Skills in English - Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	HS

Course Objectives:
Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

1. To develop listening skills for enhancing communication.
2. To develop speaking skills with a focus on correct pronunciation and fluency.
3. To introduce the need for Personality development- Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

Course Content:
Unit 1 Listening Skills
Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening tests.

Unit II Introduction to Phonetics
Sounds: consonant, vowel, diphthongs, etc. transcription of words (IPA), weak forms, syllable division, word stress, intonation, voice etc.

Unit III Speaking Skills
Standard and formal speech: Group discussion, oral presentations, public speaking, business presentations etc. Conversation practice and role playing, mock interviews etc.

Unit IV Building vocabulary
Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms and phrases. Jargon/ Register related to organizational set up, word exercises and word games to enhance self-expression and vocabulary of participants.

Recommended Readings:
1. Daniel Jones. *The Pronunciation of English.* Cambridge: Cambridge University Press, 1956.
2. James Hartman& et al. Ed. *English Pronouncing Dictionary.* Cambridge: Cambridge University

W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTER

SEMESTER: THIRD SEMESTER **SCHEME : C**

Sr.No.	SUBJECT	PERIODS			EVALUATION SCHEME							Credits
	THEORY	L	T	P	SESSIONSAL EXAM			ESE	PR(INT.)	PR (EXT.)		
					TA	CT	Total					
1	Electrical Circuit & Network	03	01	02	10	20	30	70	25	25		5
2	Electrical Machine I	03	__	03	10	20	30	70	25	50		5
3	Basic Electronics	03	--	02	10	20	30	70	25	25		4
4	Programming concept using C	02	--	02	5	10	15	35				3
5	Electrical Measuring Instrument	03	--	02	10	20	30	70	25	25		4
6	Electrical Workshop I	--	--	02	--	--	--	--	25	25		1
7	Elements of Mechanical Engineering	02			5	10	15	35				2
8	Professional Practices I	--	--	02	--	--	--	--	50			1
	Total	**16**	**01**	**15**	**50**	**100**	**150**	**350**	**175**	**150**		**25**

STUDENT CONTACT HOURS PER WEEK: **32**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam.

TA: Attendance & surprise quizzes = 6 marks. Assignment & Group Discussion = 4 marks.

Total Marks : 825

Minimum passing for sessional marks is 40%, and for theory subject 40%.

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Name of the Subject: Electrical Circuit & Network	
Course Code: EE/S3/CTN	**Semester: Third**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks
Tutorial: 1 hrs./week	Assignment & Quiz: 10 Marks
Practical: 2 hrs./week	End Semester Exam.: 70 Marks
	Practical : 50 Marks
Credit: 5 (Five)	

Aim:

Sl. No.	
1.	This subject finds utility in understanding the concepts in other electrical subjects such as Electrical Power System, Electrical Measurement and Instrumentation, & Electrical Machines etc.

Objective:

Sl. No.	The students will be able to:
1.	Define the basic elements; electric circuit terminology; energy sources used in electrical circuit and also AC waveform and its various quantities.
2.	Interpret the response of R,L,C elements to AC supply.
3.	Calculate various parameters of AC Circuits.
4.	Analyze dc and ac circuits using Mesh and Node methods
5.	Use Network Theorems for solutions of DC Networks
6.	Interpret Transient Response
7.	Use of Laplace Transform

Pre-Requisite:

Sl. No.	
1.	Series and parallel resistances, parallel & series cells

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	**Review of Basic Concepts of Electrical Circuit:** 1.1 Electrical Circuit Elements R, L, C 1.2 Voltage and Current Source. 1.3 A.C. waveform and definition of various terms associated with it. 1.4 Voltage and current response and impedance diagram of pure R, L, and C to AC supply. 1.5 Phasor representation of alternating quantity.	04	05
Unit: 2	**Single phase AC circuits & Resonance:** 2.0 Study of J operator. 2.1 Concept of complex impedance – Rectangular & polar form. 2.2 Series AC circuits R-L, R-C, R-L-C circuits. : Impedance, Reactance, Phasor diagram, Impedance Triangle, Power Factor, Active power, Apparent power, Reactive power,	10+5(T)	15

	Power triangle, complex power (Numerical). 2.3 Parallel AC circuits R-L, R-C and R-L-C circuits : Admittance, Susceptance, solution by admittance method, phasor diagram and complex Algebra method. (Numerical) 2.4 Series resonance – Effects of varying inductance and capacitance in series RLC circuit – Selectivity- 'Q' factor- Resonance frequency – Bandwidth – Half power frequencies (numerical). 2.5 Parallel resonance – Two branch parallel circuits, Q factor- Resonance frequency-bandwidth (numerical) 2.6 Comparison of series and parallel resonance.		
Unit: 3	**Principles of circuit Analysis (AC and DC circuits):** 3.1 Mesh Analysis (Numerical) 3.2 Node analysis with voltage & current source. (Numerical)	06 +2(T)	10
Unit: 4	**Network Theorems(Statement, procedure, areas of applications and limitations)** 4.1 Source conversion/ideal voltage and current source 4.2 Superposition Theorem 4.3 Thevenin's Theorem 4.4 Norton's Theorem 4.5 Maximum Power Transfer Theorem **(Numerical of all theorems)**	08 + 2(T)	10
Unit: 5	**Transient Analysis:** 5.1 Introduction 5.2 Simple R-L Circuit supplied from a DC voltage source 5.3 Simple R-C circuit supplied from a DC voltage source. 5.4 Time Constant. **(Numerical)**	08 +2(T)	10
Unit 6	**Laplace Transform:** 6.1 Definition & Properties. 6.2 Laplace Transform of Unit Step, Impulse, Ramp, Exponential, Sine, Cosine Function. 6.3 Initial value and Final Value Theorem. 6.4 Applications of Laplace Transformations for solving differential equations describing simple electrical circuits **(Numerical)**	08 +3(T)	10
Unit 7	**Two port network** : Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters and their Inter-relations.**(Simple Numerical)**	04 + 2(T)	10
	Total	**48 +16(T)**	**70**

Contents (Practical)	
Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Interpret results ii) Calculate values of various components for given circuits. ii) Select Instruments
2.	Motor Skills: i) Connect the instruments properly.

	ii) Take accurate readings. iii) Draw phasor diagram and graphs.

List of Laboratory Experiments: (At least Eight experiments are to be performed)

Sl. No.	Laboratory Experiments
1.	To verify Kirchoff's Current Law and Kirchoff's Voltage Law.
2.	To measure inductance of a choke using an external resistance in series with choke and by drawing relevant phasor diagram. Verify the result with LCR meter and calculate Q factor.
3.	To measure the current , voltage across each element of R-L-C series circuit and draw the phasor diagram to calculate p.f.
4.	To measure the current , voltage across each element of R-L-C parallel circuit and draw the phasor diagram to calculate p.f.
5.	To verify conditions for Series and Parallel Resonance.
6.	To verify following network theorems applicable to D.C. circuit. i) Superposition Theorem ii) Thevenin's Theorem
7.	To verify following network theorems applicable to D.C. circuit. i) Norton's Theorem ii) Maximum Power Transfer Theorem
8.	To study the basics of PSpice and know the important commands.
9.	To calculate network parameters of a simple d.c. circuit using Pspice.
10.	To simulate the d.c. transient response of R-L circuit using PSpice.

Text Books

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1.	Mahmood Nahvi & Joseph A Edminister	Schaum's outlines Electric circuits	McGrawhill Education (India)Pvt. Ltd.
2.	D Roy Choudhury	Networks and Systems	Wiley Eastern Limited
3.	A.Chakraborty	Circuit Theory (Analysis and Synthesis)	Dhanpat Rai & Co.
4.	S.P. Eugene Xavier	Electric Circuit Analysis	New Age International Publishers
5.	S P Ghosh & A K Chakraborty	Network Analysis & Synthesis	T.M.H. Education Pvt. Ltd.
6.	K.S. Syresh Kumar	Electric Circuit and Networks	Pearson Education
7.	Ravish R Singh	Network Analysis & Synthesis	T.M.H. Education Pvt. Ltd.
8.	Muhammad H. Rashid	Introduction to Pspice using OrCad	PHI Learning Pvt. Ltd.
9.	P. Ramesh Babu	Electric Circuit Analysis	Scitech Publication (India) Ltd.
10.	M.S. Sukhija, T.K. Nagsarkar	Circuits and Network	Oxford University Press

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,7	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the course : Electrical Machine – I	
Course Code : EE/S3/EMI	**Semester : Third**
Duration : One Semester	**Maximum Marks : 175**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 3 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 75 Marks
Credit: 5 (Five)	

Aim:

Sl. No.	
1.	Students will be able to analyze the performance of DC motors and Transformers both qualitatively and quantitatively.
2.	These machines are used in different aspects in electrical power systems. So knowledge gained by the students will be helpful in the study of different technological subjects related with electrical machines & other electrical subjects.
3.	The knowledge and skills achieved from this subject will be helpful in discharging duties in industry and as R&D technician.

Objective:

Sl. No.	Student will be able to:
1.	Describe the constructional details & working principles of DC machines & Transformers.
2.	Test DC machines & Transformers.
3.	Evaluate the performance of DC machines & Transformers by conducting different tests.
4.	Decide the suitability of DC machines & Transformers for particular purpose.
5.	Write specifications of DC machines & Transformers as required.
6.	Operate DC machines & Transformers as per requirement.

Pre-Requisite:

Sl. No.	

1.	Basic electrical engineering.		
2.	Basic electronics engineering.		
Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. GENERAL INTRODUCTION OF ROTATING MACHINE** Mechanism of Electro-Mechanical energy conversion for generator & motor mode.	**02**	**04**
Unit : 2	**2. D.C. Generator:** 2.1 Working principles, Construction & Types of dc generator. 2.2 Function of Interpole & Compensating winding. 2.3 Armature winding types – Concept of Lap & Wave winding. 2.4 E.m.f equation, Methods of building up of e.m.f, Significance of Critical resistance and Critical speed (Numerical). 2.5 Concept of flux distribution in DC machine. 2.6 Armature reaction in DC machine (Concept only). 2.7 Commutation method, Concept of reactance voltage. 2.8 Applications of different types of D.C. generator.	**10**	**12**
Unit : 3	**3. D.C. Motor:** 3.1 Working principles, Back e.m.f., Speed and Torque equation. (Numerical) 3.2 Characteristics of Series, Shunt & Compound motors. 3.3 Methods of speed control of DC motors. (Numerical) 3.4 Starting methods of DC motor – 3-point & 4-point starter. 3.5 Losses and Efficiency (Numerical). 3.6 Braking methods of DC motor – Regenerative braking, Counter current braking, Dynamic braking. 3.7 Applications of different types of DC motor.	**10**	**12**
Unit : 4	**4. Single phase Transformer:** 4.1 Principle of operation. 4.2 E.m.f. equation, Transformation ratio, KVA rating. (Numerical) 4.3 Types of transformer, Core construction & different parts of	**17**	**30**

	transformer and their function. 4.4 Concept of ideal transformer. 4.5 Different types of cooling methods (in brief). 4.6 Performance under no-load condition with phasor diagram. (Numerical) 4.7 Performance under load condition with phasor diagram. (Numerical) 4.8 Equivalent circuit. (Numerical) 4.9 Per unit representation of impedance. 4.10 Voltage Regulation at upf, lagging pf & leading pf. (Numerical) 4.11 Polarity test of transformer. 4.12 O.C. and S.C. tests – Estimation of losses & Equivalent circuit parameters. (Numerical) 4.13 Losses, Efficiency, Maximum efficiency, All-day efficiency. (Numerical) 4.14 Parallel operation of single phase transformers. (Numerical) 4.15 Tap-changing methods, Tap changers – Off load & On-load type. 4.16 Principles of single-phase Auto transformer – step-up & step-down, Comparison of weight, copper loss with 2-winding transformer. (Numerical) 4.17 Applications of 2-winding transformer & Auto transformer.		
Unit : 5	**5. Three phase Transformer:** 5.1 Types of three phase transformer. 5.2 Construction of 3-phase transformer – Core & different types of Winding. 5.3 Connections of 3-phase transformer – Vector grouping (classification & necessity). 5.4 Concept of Tertiary winding and its utility. 5.5 Three-phase Auto transformer – working principle, connection diagram, Step-up & Step-down autotransformer. (Numerical) 5.6 Comparison of Autotransformer with two-winding	**09**	**12**

	transformer, practical application of autotransformer. 5.7 Scott-connected transformer – working principle, connection diagram, practical application. 5.8 Open delta connection – working principle, connection diagram, practical application. 5.9 Applications of 3-phase transformer.		
	Total	**48**	**70**

Practical:
Skills to be developed:
Intellectual skills:
1. Analytical skills.
2. Identification skills.
Motor skills:
1. Measurement (of parameters) skills.
2. Connection (of machine terminals) skills.
List of Practical: (At least Eight experiments are to be performed)
1. To plot the O.C.C. of a D.C. generator & find the critical resistance.
2. To find the performance of a D.C. Series motor by conducting load test & draw the load characteristics.
3. To find the performance of a D.C. shunt motor by conducting load test & draw the load characteristics.
4. To compute the efficiency of a D.C. motor by Swinburn's test.
5. To control the speed of D.C. shunt motor above & below normal speed & draw the speed characteristics.
6. To determine equivalent circuit parameters of single-phase transformer by performing O.C. test and S.C. test.
7. To determine the regulation & efficiency of single-phase transformer by direct loading method.
8. To operate two single-phase transformers in parallel & find out the load sharing between them.
9. To perform heat run test of a single-phase transformer.
10. To compute the efficiency of a single-phase transformer by Back-to-Back test.

Text books:			
Sl No.	Titles of Book	Name of Author	Name of Publisher
1.	Electrical Machines	S.K.Bhattacharya	T.M.H Publishing Co. Ltd.
2.	Electrical Machinery	Dr. S.K.Sen	Khanna Publisher
3.	Electrical Machines	Nagrath & Kothari	T.M.Hill
4.	Electrical Machines	Ashfaq Husain	Dhanpat Rai & Co.
5.	Electrical Machines	J.B.Gupta	S.K.Kataria & Sons.
6.	Principles of Electrical Machines and Power Electronics	P.C.Sen	Wiley India
7.	Electrical Machines-I	K.Krishna Reddy	Scitech Publication (India) Pvt. Ltd.
8.	Electrical Technology- Vol-II	B.L.Thereja	S.Chand
9.	Principles of Electrical Machines	V.K.Mehta, Rohit Mehta	S. Chand
10.	Electrical Machinery	P.S.Bhimbra	Khanna Publisher
11.	Electrical Machines	M.N.Bandyopadhyay	P.H.I. Pvt. Ltd.
12.	Fundamentals of Electrical Machines	B.R.Gupta & V.Singhal	New Age Publisher
13.	Electrical Technology	H.Cotton	C.B.S. Publisher New Delhi
14.	Electrical Machines	Smarajit Ghosh	Pearson

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	09	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5	13				SIX			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 35, Viva-voce – 15.**

Name of the course : Basic Electronics	
Course Code : EE/S3/BE	**Semester : Third**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 4(Four)	

Aim:

Sl. No.	
1.	This subject is the base of all advance electronics. It starts with semiconductor physics and P-N junction which makes the student to follow the functioning of all semiconductor based devices.
2.	Understanding of the subject will provide skill to the students for trouble shooting & testing of some basic electronic components and circuits.

Objective:

Sl. No.	Student will be able to:
1.	Describe the formation of P-N junction.
2.	Draw the characteristics of basic components like diode, transistor etc.
3.	Draw & describe the basic circuits of rectifier, filter, regulator & amplifier.
4.	Test diode and transistors.
5.	Read the data sheets of diode and transistors.

Pre-Requisite:

1.	Knowledge of physics and P-N junction.

Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. Diode:** **1.1 Semiconductor Diode:** 1.1.1 Fundamentals of semiconductor – Energy bands (conduction & valence), Intrinsic & Extrinsic semiconductor, Concept of P-N junction, Diffusion, Barrier potential, Depletion region, Junction capacitance. 1.1.2 Forward & Reverse biasing of P-N junction, Diode symbol, Circuit diagram for characteristics of diode (Forward & Reverse), Characteristics of diode. 1.1.3 Diode specifications – Forward voltage drop, reverse saturation current, maximum forward current, power dissipation, package view of diodes of different power ratings. **1.2 Zener Diode:** 1.2.1 Construction, Symbol, Circuit diagram for characteristics of zener diode (Forward & Reverse), Zener & Avalanche Breakdown. 1.2.2 Zener diode specifications – zener voltage, power dissipation, break over current, dynamic resistance & maximum reverse current. **1.3 Other Diodes:** Shottky diode, Photo diode – operating principles & applications of each only.	**10**	**14**
Unit : 2	**2. Rectifiers & Filters:** 2.1 Need of rectifier, Types of rectifier - Half wave & full wave rectifier (Bridge & Centre tapped). 2.2 Circuit operation of the rectifiers, Input & output waveforms for voltage & current, Average value of voltage & current (expression only), Ripple, Ripple factor, Ripple frequency, form factor, PIV of diode used, Rectifier efficiency. 2.3 Need of filters, Types of filter – a) Series inductor, b) Shunt capacitor, c) LC filter, d) π filter. 2.4 Circuit operation of the filters, limitations & advantages.	**07**	**10**

Unit : 3	**3. Transistors:** **3.1 Bipolar Junction Transistor (BJT):** 3.1.1 Symbol of NPN & PNP types, Construction, Different types of package, Operation of NPN and PNP transistor – current flow, relation between different currents. 3.1.2 Transistor amplifying action – Transistor configurations – CB, CE, CC, circuit diagram for input & output characteristics of each configuration, Input & output characteristics. Comparison between three configurations. 3.1.3 Transistor parameters – input & output resistance, α, β and relation between them. 3.1.4 Transistor specification – $V_{CE\ Sat}$, $I_{C\ Max}$, V_{CEO}, I_{CEO}, $V_{CE\ Breakdown}$, α, β, Power dissipation. **3.2 Field effect transistor (JFET):** Symbol, Construction of JFET, Working principle and V-I characteristics of JFET, pinch-off voltage, drain résistance, transconductance, amplification factor and their relationship. **3.3 Unijunction transistor (UJT):** Symbol, Construction, Working principle and characteristics of UJT, Equivalent circuit, UJT as relaxation oscillator, Applications.	**10**	**14**
Unit : 4	**4. Biasing of BJT:** 4.1 Need of biasing, concept of DC load line, selection of Q point and stabilization. 4.2 Types of biasing circuits (concept only) – a) Fixed biased circuit, b) Base biased with emitter feedback, c) Base biased with collector feedback, d) Voltage divider biasing, e) Emitter biased.	**06**	**10**
Unit : 5	**5. Regulated Power Supply:**	**06**	**08**

	5.1 Need of regulation, voltage regulation factor. 5.2 Concept of load regulation & line regulation. 5.3 Zener diode voltage regulator. 5.4 Linear regulators – 5.4.1 Basic block diagram of DC power supply. 5.4.2 Shunt and series regulator using transistor – circuit diagram and operation. 5.4.3 Regulator IC's- IC78xx, IC79xx, IC723 – their Pin configuration, operation and practical applications.		
Unit : 6	**6. Small Signal Amplifiers:** 6.1 Small signal amplifier using BJT. 6.2 Determination of current, Voltage & Power gain, phase shift between input and output, Input and Output resistance, Graphical analysis of amplification. 6.3 AC load line. 6.4 Function of input & output coupling capacitors, emitter bypass capacitor. 6.5 Single stage CE amplifier with voltage divider bias – operation with circuit diagram. 6.6 Frequency response of Single stage CE amplifier, Bandwidth and its significance. 6.7 Need of Cascade (multistage) amplifiers, Gain of amplifier. 6.8 Types of amplifier coupling – RC, Transformer & Direct coupling.	**09**	**14**
	Total	**48**	**70**
Practical:			
Skills to be developed:			

Intellectual Skills:
1. Identification & selection of components.
2. Interpretation of circuits.
3. Understand working of basic instruments.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to measure various parameters.
3. Ability to test the components using multimeter.
4. Follow standard test procedures.
List of Practicals: (No.1&2 and At least Six experiments are to be performed from the rest)
1. Identification & Checking methods of the following basic components – Resistor, Potentiometer, Capacitor (polarised, Non-polarised), Choke coil, Diode, Zener diode, Transistor (NPN & PNP), Thyristor, Diac, Triac, UJT, IGBT, MOSFET, JFET, OPAMP(IC741), IC78XX, IC79XX.
2. To be familiar with the following basic instruments**:** — Digital Multimeter, Oscilloscope, Power supply (single / dual channel), Function generator, LCR Meter.
3. To plot the forward & reverse characteristics of P-N junction diode.
4. To construct half-wave & full-wave rectifier circuit & draw input, output waveforms.
5. To Plot the characteristics of Zener diode.
6. To study the Zener diode as voltage regulator & calculate load regulation.
7. To plot the characteristics of FET.
8. To plot the characteristics of UJT.
9. To plot the input & output characteristics of a BJT in CE or CB mode.
10. To construct a single stage CE amplifier circuit on a bread board to find out the gain and observe the input and output waveforms.
11. To construct a single stage CE amplifier circuit on a bread board to find out the gain at different frequency and plot Gain vs. Frequency characteristics and also find out the Bandwidth.
12. To construct a ±12V power supply on bread board and observe the output waveform by CRO with and without filter circuit. Also observe the output voltage using IC regulator 78XX & 79XX.

List of Text Books:

Sl. No.	Title of the Books	Name of Author	Name of Publisher
1.	Electronic Principles	Albert Malvino & D.J.Bates	T.M.Hill
2.	Basic Electronics	S.K.Mandal	T.M.Hill
3.	Electronic Devices & Circuits	A.K.Maini, V.Agarwal	Wiley India
4.	Electronic Devices & Circuits	S.Salivahanan, N.Suresh Kumar	T.M.Hill
5.	Electronic Circuits & Systems	Y.N.Bapat	T.M.Hill
6.	Electronic Devices & Circuits	David J.Bell	P.H.I. Pvt. Ltd.
7.	Basic Electronics for Polytechnics	S.Chowdhury	Dhanpat Rai & Co.
8.	Electronics Engineering	J.B.Gupta	S.K.Kataria & Sons
9.	Electronic Devices & Circuits	P.John Paul	New Age International
10.	Electronic Devices & Circuits	Chereku & Krishna	Pearson Education

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Course: Programming concept using C	
Course Code: EE/S3/C	**Semester: Third**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester Exam.: 10 Marks
Practical: 2 hrs./week	Assignment & Quiz: 05 Marks
	End Semester Exam.: 35 Marks
	Practical : Nil
Credit: 3 (Three)	

Aim:

Sl. No.	
1.	Programming concept finds utility in understanding the subjects such as Microprocessor, Microcontroller, PLC etc. It will also become helpful to understand various application Software such as Matlab, Pspice etc.

Objective:

Sl. No.	The students will be able to:
1.	Define program and programming
2.	understand compiler, interpreter, linker and loader function.
3.	Understand algorithm and different ways of stating algorithms.
4.	Understand the basic structure of a program in C
5.	Explain data types, variables, constants, operators etc.
6.	Understand the input and output streams that exist in C to carry out the input output task.
7.	Illustrate decision type control construct and looping type control constructs in C.
8.	Describe one dimensional array.
9.	Understand what a function is and how its use benefits a program

Pre-Requisite:

Sl. No.	
1.	Basic units of computer system

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Introduction to Programming: Algorithms and Flowcharts** 1.1 Programs and Programming 1.2 Programming Languages 1.3 Compiler, Interpreter, Assembler, Loader, and Linker 1.4 Fourth Generation Languages 1.5 Structured Programming Concept 1.6 Algorithm – Features and its applications 1.7 Flow Chart – Features and its applications	05	8
Unit: 2	**Overview of C Programming** 2.1 Introduction of C Language 2.2 Basic Structure of C 2.3 Working steps of C compilation – Source Code-	02	3

	Object Code – Executable object code.		
Unit: 3	**Types, Operator & Expression** 3.1 Introduction (Grammars/Syntax Rules) 3.2 Character Sets, Keywords, Identifiers, Constants, Variables 3.3 Data types and sizes 3.4 Different operators & expressions 3.5 Type conversions.	05	5
Unit: 4	**Managing Input & Output Operations** 4.1 Some input as well as output functions : scanf(), printf(), getchar(), putchar(),getch(),getche(), gets(), puts().	02	3
Unit: 5	**Control Flow (Decision Making)** 5.1 Introduction 5.2 if…else, switch----case statement 5.3 Looping : for, while and do…..while statements 5.4 break, continue and goto statements. 5.5 Simple Program	06	6
Unit 6	**Arrays** 6.1 Introduction 6.2 Declaration and initialization of Array 6.3 Accessing of array elements and other allowed operations. 6.4 Simple program with a one dimensional array	06	5
Unit 7	**User defined Function** 7.1 The concepts of user defined functions. 7.2 Using functions : i) Function Declaration, ii) Function Definition, iii) Function Call 7.3 Simple program	06	5
	Total	**32**	**35**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Improvement of Logical thinking capability ii) Improvement of analytical thinking capability
2.	Motor Skills: i) Operate various parts of computer properly. ii) Problem solving skills. iii) Draw Flow charts

List of Laboratory Experiments:

Sl. No.	
	Write algorithm, Draw Flow chart, and Write programming codes in C on following topics
1.	To find the sum and identify the greater number between any two numbers.
2.	To interchange the numeric values of two variables.
3.	Take three sides of a triangle as input and check whether the triangle can be drawn or not. If possible, classify the triangle as equilateral, isosceles, or scalene
4.	To test whether the given character is vowel or not using “if…else” and “switch….case”
5.	To find sum of the digits of an integer .
6.	To find the roots of a quadratic equation.

7.	To check whether an input number is palindrome or not.
8.	To find the G.C.D and L.C.M of two numbers.
9.	To find the factorial of given number.
10.	To find the sum of n natural numbers.
11	To accept 10 numbers and make the average of the numbers
12	To accept 10 elements and sort them in ascending or descending order.
13.	To find the summation of three numbers using function.
14	To find the maximum between two numbers using function

Text Books

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1.	Pradip Dey and Manas Ghosh	Computer Fundamental and Programming in C	Oxford Higher Education
2.	T . Jeyapoovan	A first course in Programming with C	Vikas Publishing House Pvt. Ltd.
3.	K R Venugopal and S R Prasad	Mastering C	T.M.H. Publishing Company Ltd.
4.	Reema Theraja	Introduction to C Programming	Oxford University Press.
5.	E. Balaguruswamy	Programming in ANSI C	T.M.H. Publishing Company Ltd.
6.	Byron Gottfried	Schaum's Outlines Programming with C	T.M.H.
7.	Ashok N. Kamthane	Programming in C	Pearson

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (THEORY)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	5	TEN	ONE	1 X 10 = 10	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	FIVE	5 X 5 = 25
B	4,5,6,7	7				FIVE			

Name of the Course: Electrical Measuring Instruments	
Course Code: EE/S3/EMI	**Semester: THIRD**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 2 hrs./week	End Semester Exam.: 70 Marks
	Practical : 50 Marks
Credit: 4 (Four)	

Aim:

Sl. No.	
1.	This subject finds utility in understanding the concepts in other electrical subjects such as Electrical Power System, Electrical Circuit Theory & Electrical Machines etc.
2.	The Diploma holder has to work as Technical supervisor, maintenance engineer, production engineer in industries, electrical power generation, transmission and distribution system, traction installation system, machine operation etc.
3.	For above job responsibilities he has to take the measurements of various electrical quantities power & energy for testing, monitoring, maintenance, and controlling the process. In addition to this he must know the calibration techniques and extension of meter ranges. Therefore Electrical Measurement skills are very important. Accuracy of measurement is one of the main parameters in industrial processes as ability of control depends upon ability to measure.

Objective:

Sl. No.	**The students will be able to**:
1.	Identify the measuring instruments used for measuring electrical quantities.
2.	Classify measuring instruments based on construction, principle of operation and quantity to be measured, types of errors.
3.	Select appropriate measuring instrument with range for measurement of various electrical quantities.
4.	Calibrate various types of instruments as per IS..

Pre-Requisite:

Sl. No.	
1.	Knowledge of current, voltage & power and their measurements.

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Name of the Topic :Fundamentals of Measurement**	6	8

	1.1 Purpose of measurement and significance of measurement. 1.2 Definition & brief explanations of: Range, sensitivity, true & indicated value, Errors (including limiting errors), Resolutions, Accuracy, Precision and instrument efficiency. 1.3 Classification of instruments: Absolute and secondary instruments, Analog (electro-mechanical and electronic) and digital instruments, secondary Instruments - Indicating, integrating & recording instruments. 1.4 Basic Requirements for measurements: Deflection torque and methods of production. Controlling torque and controlling system (Spring Control & Gravity control system) Damping torque & different methods of damping Balancing of moving parts. [No mathematical deductions – only the final expression (if any) to be mentioned]		
Unit: 2	**Name of the Topic**: **Measurement of Current and Voltage** 2.1 Construction and principle of PMMC, MI & Dynamometer type Instrument. 2.2 Production of torque :methods. 2.3 Principles of Voltage and Current measurement. 2.4 Different Methods of range extension of Ammeter and Voltmeter & related problems. 2.6 Calibration of Ammeter and Voltmeter.	7	10
Unit: 3	**Name of the Topic**: **Measurement of Electrical Power** 3.1 Concept of power in A.C. Circuit 3.2 Principle and Construction of dynamometer type wattmeter. 3.3 Errors and their compensation. 3.4 Multiplying factor of wattmeter. 3.5 Measurements of power in 3 phase circuit for balanced and unbalanced load by one wattmeter method, two wattmeter method - problems 3.6 Effect of power factor variation on wattmeter readings in two wattmeter method -problems 3.7 Measurement of reactive power in three phase balance load by one wattmeter method and two wattmeter method.	9	15

	3.8 Digital Wattmeter : Construction, Principle of Operation		
Unit: 4	**Name of the Topic** :**Measurement of Electrical Energy** 4.1 Concept of electrical energy. 4.2 Constructional feature & principle of working of single phase and three-phase induction type energy meter. 4.3 Different types of errors and their compensation. 4.4 Calibration and Testing of energy meter. 4.5 Electronic energy meter : Basic circuit diagram and principle of operation 4.6 Phantom loading |	7	10
Unit: 5	**Name of the Topic** : **Measurement of Circuit Parameters** 5.1 Classification of Resistance, Low, Medium and High. 5.2 Methods of Measurements of Low, Medium and High. Resistance by Kelvin Double bridge, Wheatstone bridge and Megger respectively--problems 5.3 Measurement of Earth resistance- Earth tester (Analog & Digital) 5.4 Measurement of Inductance:---Maxwell's inductance bridge -- problems 5.5 Measurement of capacitance: Schering Bridge - Problems	10	15
Unit: 6	**Name of the Topic : Constructional features and working principles of other Instruments/Meters** 6.1 Single phase and three phase Power Factor Meter(only dynamometer type). 6.2 Digital Multimeter: Working principle with Block diagram. 6.3 Sychronoscope. 6.4 Clip-on-mmeter. 6.5 Instrument Transformers: Introduction and utility of using Instrument transformers (in the light of measurement and protection purposes) 6.6 CT (i) CT used in HV installations- Multicore-secondary C.T (ii) Reduction of errors (Mention the various methods briefly). Accuracy class, Burden on CT, Specifications, Precautions in the use of CT 6.7 PT or VT Working principle, Errors (concept only), Accuracy class, Burdens, Specifications, Precautions.	9	12
	Total	**48**	**70**

Text Books:

Name of Authors	Title of the Book		Name of the Publisher
A.K. Sawhney	Electric & Electronic Measurement and Instrumentation		Dhanpat Rai & Sons
Golding, Widdies	Electrical Measurement & measuring Instrument		Wheeler
N.V.Suryanaryan	Electrical Measurement & measuring Instrument.		S. Chand & Co.
J.B. Gupta	Electrical & Electronic Measurements		S. K. Kataria Publication
S.K.Singh	Industrial Instrumentation & Control		Tata McGraw Hill
David A.Bell	Electronic Instrumentation and Measurements		OXFORD Higher Education
P.Purkait, B. Biswas, S, Das, C. Koley	Electrical and Electronics Measurements and Instrumentation		Tata McGraw Hill
Reddy	Electrical Measurement		Scitech Publication (India) Ltd.

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Identification of instruments 2. Selection of instruments and equipment for measurement
2.	Motor Skills: 1. Accuracy in measurement 2. Making proper connections

Suggested list of Laboratory Experiments:

Sl. No.	**List of Practical:**
1.	a) To measure Resistance, Voltage, Current, in A.C & D. C. Circuit using digital multimeter. b) To measure A.C. Current by Clip-on ammeter.
2.	To measure Low resistance by Kelvin's Double Bridge.
3.	To measure active and reactive power in three phase balanced load by two wattmeter method and observe the effect of Power Factor variation on Wattmeter reading.
4.	To calibrate single phase Energy meter using resistive and inductive loads.
5.	To measure energy of three phase balanced load using Electronic Energy Meter.

6.	To measure an inductance by Maxwell's bridge.
7.	To measure an unknown capacitance by Schering Bridge.
8.	To measure power factor of single phase and three phase load by PF meter and verify the same through I, V and P measurement.
9.	To measure current & voltages by low range ammeter & voltmeter respectively using CT and PT.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	TWO	TEN	10 X 5 = 50
B	4,5,6	11				FIVE	THREE		

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Course: Electrical Workshop	
Course Code: EE/S3/WS	**Semester: THIRD**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	**Practical : 50 Marks**
Tutorial:	
Practical: 2 hrs./week	
Credit: 1 (One)	

Aim:	
Sl. No.	
1.	A technician should also have the practical skills regarding wiring, in order to provide him/her the various ways, techniques of fault finding while working on the shop floor. These skills will be developed when he/she actually performs the work.

Objective:	
Sl. No.	
1.	Identify various electrical accessories.
2.	Draw & understand the wiring diagrams
3.	Prepare schedule of material
4.	Use methods of wiring

Pre-Requisite:	
Sl. No.	
1.	Studies of different types of wires, switches, circuits.
2.	Protection for safety of electrical wiring installation as per I.S.
3.	Protection against electric shock, thermal effect, over-current, over-voltage, under-voltage and against a measure of isolation and switching of electrical circuits.

Contents (Practical)	
Suggested list of Practicals/Exercises:	
1.	To study MCB, ELCB and RCCB and to know their applications.
2.	To Mount and wire up the main board by batten/conduit wiring and connect Energy Meter, MCB, ELCB, RCCB etc. as per IE rule.
3.	To Study the constructional features and windings of different types of D.C. Machines.
4.	To demonstrate the D.C. motor starters (3 pt. & 4 pt.starter).
5.	To dismantle and assemble of a ceiling-fan/Table fan and study the specifications of major components.
6.	To test a battery for its charged and discharged condition and to make connections for charging and obtain its capacity.
7.	To demonstrate the connection of fire-alarm along with cable, sensors and symbolic display (do's and don'ts) and maintenance.
8.	To measure insulation resistance using Megger.
9.	To measure earth resistance using Earth Taster.

EXAMINATION SCHEME

1. **Continuous Internal Assessment of 50 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Course: Elements of Mechanical Engineering	
Course Code: EE/S3/EMCE	**Semester: Third**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs/week	Mid Semester Exam.: 10 Marks
Tutorial:	Assignment & Quiz: 05 Marks
Practical:	End Semester Exam.: 35 Marks
Credit: 2 (Two)	

Aim:

Sl. No.	
1.	Diploma in Electrical Engineering passes outs, work as Maintenance Engineers in industry. They have to look after maintenance of Mechanical Machines also. For completing these tasks they need knowledge of Mechanical Machinery related to maintenance

Objective:

Sl. No.	
1.	• Supervise routine maintenance of Machinery such as Boilers, Turbines, Pumps, Steam Turbines etc.
2.	• Identify faults, mal functioning of machines and equipment

Pre-Requisite:

Sl. No.	
1.	Studies of applied mechanics & Engineering Drawing.

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Thermodynamics, Refrigeration and Air Conditioning** 1.1 Laws of Thermodynamics. 1.2 Comparison between Heat Engine, Heat Pump and Refrigeration. 1.3 Definition of refrigeration, ton of refrigeration, COP, enthalpy, entropy. 1.4 Vapour Compression System (Basic concept). 1.5 Vapour absorption system (Basic concept). 1.6 Comparison of Vapour Compression and Vapour absorption system. 1.7 Working principle of Domestic Refrigerator. 1.8 Air Conditioning System & factors affecting the human comfort. 1.9 Classification of Air conditioner and comparison between Window Air Conditioning system and split type air conditioning system. 1.10 Working principle of Room Air conditioner.	08	8

Unit: 2	**Boilers, Steam Turbines, Steam Engines:** 1.1 Layout of modern Steam Power Plant. 1.2 Definition and classification of Boiler and their applications. 1.3 Working principle of Fire Tube (Cochran), water Tube (Babcock & Willcox Boiler) and Modern High Pressure Boiler. 1.4 Definition and classification of Steam Turbine. 1.5 Working Principle of impulse and reaction Turbine. 1.6 Major troubleshooting and remedial measures for boiler & turbine.	08	08
Unit: 3	**I.C. Engines:** 2.1 Definition & classification. 2.2 Main parts of an I.C. Engine & their functions 2.2 Working Principle of 2 stroke & 4 stroke Petrol & Diesel Engine, their differences and applications. 2.3 Major troubleshooting & remedial measures for I.C. Engines.	05	7
Unit: 4	**Air Compressors:** 3.1 Definition, Classification & application of Air Compressor. 3.2 Construction & Working Principle of Single stage reciprocating Compressor. 3.3 Working Principle of centrifugal and Screw Compressor. 3.4 Major troubleshooting & remedial measures for Air Compressor.	05	5
Unit : 5	**Hydrostatics & Pumps:** 4.1 Atmospheric pr. , Absolute pr. & Gauge pressure. 4.2 Determination of pressure at a point, pressure measuring instrument. 4.3 Classification of Pumps and their applications. 4.4 Working principle of Single acting & Double acting Reciprocating pump. 4.5 Working principle of Centrifugal Pump. 4.6 Reason for malfunctioning & remedial measures for Pumps.	06	7
	Total	**32**	**35**

Text Books:			
Name of Authors	Title of the Book	Edition	Name of the Publisher
P.L. Ballaney	A Course in Thermal Engineering		Khanna Publishers
R. S. Khurmi	A test book of Thermal Engineering		S. Chand & Co. Ltd.
R. K. Rajput	Thermal Engineering		Laxmi Publication, New Delhi
Patel, Karmchandani	Heat Engine Vol. I & II		Achrya publication
P.K. Nag	Engineering Thermodynamics		Tata McGraw Hill
P.Selvaraj, M.Periyasamy,S.Selva kumar	Basic Civil and Mechanical Engineering		Scitech Publications (India) Pvt Ltd.
T.J.Prabhu, V.Jaiganesh	Basic Mechanical Engineering		Scitech Publications (India) Pvt Ltd.

EXAMINATION SCHEME

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	6	TEN	ONE	1 X 10 = 10	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	FIVE	5 X 5 = 25
B	3,4,5	6				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the required as allotted.

Name of the Course: Professional Practices I	
Course Code: EE/S3/PF1	**Semester: Third**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 2 hrs / week	End Semester Exam.: Marks
	Practical : 50 Marks
Credit: 1 (One)	

Aim:

Sl. No.	
1.	Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.
2.	While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.
3	The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objective:

Sl. No.	The student will be able to
1.	Acquire information from different sources
2.	Prepare notes for given topic
3.	Present given topic in a seminar
4	Interact with peers to share thoughts
5	Prepare a report on industrial visit, expert lecture

Pre-Requisite:

Sl. No.	
1.	Desire to gain comparable knowledge and skills of various activities in various areas of importance.
2.	Eagerness to cohesively participate in group work and to share thoughts with group members.

3.	Knowledge of basic electrical engineering.

Activities

Sr . No.	Activities	Hours
1.	Industrial / Field Visit : Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to **<u>any ONE</u>** from the list below: i) Nearby Petrol Pump.(fuel, oil, product specifications) ii)Automobile Service Station (Observation of Components / aggregates) iii) Telephone Exchange iv) Food Processing industry (Lay out and machine) v) Tea processing industry (Lay out and machine) vi) Dairy Plant / Water Treatment Plant (Lay out and machine) vii) Community health Centre (organization, modus-operandi, various activities) viii) Panchayet/ BDO office to understand swarojkar yojona / gram sarak yojona scheme / Rural electrification and Report on a particular/ specific case.	**10**
2.	**Guest Lecture by professional / industrial expert**: Lectures by Professional / Industrial Expert to be organized from **<u>any THREE</u>** of the following areas: i) Free and open source software ii) Software for drafting iii) Non destructive testing iv) Acoustics v) Illumination / Lighting system. vi)Common electricity rules & norms(do's and don'ts) for all vii) Automobile pollution, norms of pollution control viii) Fire Fighting / Safety Precautions and First aids.	**6**

	ix) Public health & Hygiene awareness. x) Working around trucks - loading and unloading of engineering machineries. xi) Industrial hygiene. xii) Special purpose wiring in chemical / hazardous industries. xiii) Safe application of electrical energy in daily life. xiv) Energy and environment xv) Carbon Trading. xvi) Topics related to Social Awareness such as - Traffic Control System, Career opportunities, Communication in Industry, Yoga Meditation, Aids awareness and health awareness. Individual report of the above lecture should be submitted by the students	
3.	**Group Discussion:** The students should discuss in a group of six to eight students. Each group to perform **<u>any TWO</u> group discussions**. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested areas are - i) Sports ii) Social networking - effects & utilities iii) Current news item iv) Discipline and house keeping v) Use of plastic carry bag (social & domestic Hazard) vi) Any other common topic related to electrical field as directed by concerned teacher.	**10**

4.	**Students' Activities:** The students in a group of 3 to 4 will perform ANY ONE of the following activities: i) Collect and study IS code for Engineering Drawing. ii) Specifications of Lubricants. iii)Draw orthographic projections of a given simple machine element using CAD software	**6**

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous internal assessment of 50 marks** is to be carried out by the teachers throughout the third semester. **Distribution of marks: Activities =20, Group Discussion = 10, field visit = 10, guest lecture attendance and report = 10**

W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTERS

SEMESTER: FOURTH SEMESTER **SCHEME : C**

Sr.No.	SUBJECT	PERIODS			EVALUATION SCHEME							Credits
	THEORY	L	T	P	SESSIONSAL EXAM			ESE	PR(INT.)	PR (EXT.)		
					TA	CT	Total					
1	Electrical Machine II	03		03	10	20	30	70	25	50		5
2	Electrical Measurement & Control	03	--	02	10	20	30	70	25	25		4
3	Transmission & Distribution of Power	03	_	02	10	20	30	70	25	25		4
4	Applied and Digital Electronics	03	--	02	10	20	30	70	25	25		4
5	Power Plant Engineering	04	--		10	20	30	70				4
6	Computer aided Electrical Drawing		--	03	--	--	--	--	25	25		2
7.	Development of Life Skill - II	01	--	02					25	25		2
8.	Professional Practice - II			02					50			1
	Total	**17**		**16**	**50**	**100**	**150**	**350**	**200**	**175**		**26**

STUDENT CONTACT HOURS PER WEEK: **33 HRS**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam.

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.

Total Marks : 875

Minimum passing for sessional marks is 40%, and for theory subject 40%.

Name of the Subject : Electrical Machine – II	
Course Code : EE/S4/EM II	**Semester : Fourth**
Duration : One Semester	**Maximum Marks : 175**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 3 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 75 Marks
Credit: 05	

Aim:

Sl. No.	
1.	Students will be able to analyze the performance of 3-phase and single phase A.C motors and 3-phase Alternators both qualitatively and quantitatively.
2.	These machines are used widely in various Industries and Power plants. So knowledge gained by the students will be helpful in their job in industry and power plants.

Objective:

Sl. No.	Student will be able to:
1.	Interpret the constructional details & working principles of A.C motors & generators.
2.	Test A.C motors & generators.
3.	Evaluate the performance of A.C machines by conducting different tests.
4.	Decide the suitability of AC machines for particular purpose.
5.	Write specifications of A.C motor & generators as required.
6.	Operate AC motor & generators as per requirement.

Pre-Requisite:

Sl. No.	
1.	Three phase & single phase A.C fundamentals, Electromagnetism.
2.	Basic electronics engineering.

	Contents (Theory):	Hrs./Unit	Marks
Unit : 1	**1. Three-Phase Induction Motor:** 1.1 Construction of 3-phase induction motor. 1.2 Production of rotating magnetic field. 1.3 Working principle of 3-phase induction motor. 1.4 Concept of Synchronous Speed & Slip. 1.5 Equation of rotor induced emf, current, frequency, reactance & impedance under standstill and running condition. **(Numerical)** 1.6 Vector diagram (at no-load & running condition). 1.7 Concept of Equivalent circuit (at no-load, at blocked rotor and at running condition).**(No Numerical)** 1.8 Derivation of Torque equation, Starting torque, Running torque, Maximum torque and condition for maximum torque. **(Numerical)** 1.9 Torque- Slip characteristics, Effect of change in rotor circuit resistance and supply voltage on Torque-Slip characteristics. 1.10 Power stages in 3-phase induction motor and their relation, Losses, Efficiency. **(Numerical)** 1.11 Starting methods of 3-phase induction motor by– a) Rotor resistance starter. b) Direct -On-Line starter. c) Autotransformer starter.	**14**	**24**

	d) Star-Delta starter (Manual & Automatic).**(Numerical for all starter)** 1.12 Speed control of 3-phase induction motor by – a) Changing supply frequency. b) Pole changing method. c) Changing Rotor circuit resistance & stator reactance. d) Changing supply voltage. 1.13 Braking of 3-phase induction motor by – a) Plugging. b) Rheostatic method. c) Regenerative method. 1.14 Cogging & Crawling (simple idea) 1.15 Concept of Double cage rotor & Deep-bar rotor. 1.16 Motor enclosures and specification as per I.S Code. 1.17 Industrial applications of 3-phase induction motor.		
Unit : 2	**2. Alternator:** 2.1 Construction of 3-phase alternator, Description of salient & non-salient rotor. 2.2 Methods of excitation systems of 3-phase alternator by – a) Static excitation. b) Brushless excitation. c) DC generator. 2.3 Advantages of Stationary armature and Rotating field system. 2.4 Armature winding – Single layer and multilayer, Concentrated and Distributed (Concept only). 2.5 Derivation of E.M.F. equation of 3-phase alternator, Effect of Coil span factor and Distribution factor on emf, Winding factor. **(Numerical)** 2.6 Factors affecting the terminal voltage of alternator – a) Armature resistive drop b) Leakage reactance drop. c) Armature reaction at various p.f, concept of Synchronous reactance. 2.7 Phasor diagrams of cylindrical rotor alternator at lagging, leading & unity p.f. loads. 2.8 Voltage regulation of 3-phase alternator by – **(Numerical)** a) Synchronous Impedance Method. 2.9 Open circuit characteristics, Short circuit characteristics of alternator and determination of synchronous reactance. 2.10 Active & Reactive power equations in terms of load angle at steady state for non-salient pole alternator. 2.11 Steady-state characteristics of Alternator – a) Terminal voltage vs. Load current, at different p.f, b) Field current vs. Load current at different p.f, c) Active & Reactive Power vs. load angle (non-salient alternator). 2.12 Short circuit ratio (SCR) – concept & significance. 2.13 Method of control of Active & Reactive Power of an alternator. 2.14 Reasons & advantages of Parallel operation. 2.15 Synchronization of two or more alternators by - a) Three lamps method. b) Synchroscope. 2.16 Parallel operation of (i) an alternator & infinite bus and (ii) Between two alternators & Load sharing between them.**(Numerical)**	**14**	**24**
Unit : 3	**3. Synchronous Motor:** 3.1 Construction and working principle. 3.2 Methods of starting by – a) An auxiliary motor. b) Damper winding.	**08**	**08**

	3.3 Effect of variation of Load – Speed vs. Torque characteristics. 3.4 Effect of variation of excitation at infinite bus (over and under excitation) – V curves & inverted V-curves. 3.5 Hunting, George's phenomenon. 3.6 Applications of synchronous motor, Synchronous condenser.		
Unit : 4	**4. Single phase motors:** 4.1 Double-revolving field theory. 4.2 Construction, Principle of operation and Applications of different types of single-ph Induction motors – a) Split phase (resistance) type. b) Capacitor start type. c) Capacitor run type. d) Shaded pole motors.	**05**	**08**
Unit : 5	**5. Special Machines:** 5.1 Linear induction motor. 5.2 Induction generator. 5.3 A.C series motor. 5.4 Reluctance Motor.	**07**	**06**
	Total	**48**	**70**

Practical:

Skills to be developed:

Intellectual skills:

1. Analytical skills.
2. Identification skills.

Motor skills:

1. Measurement (of parameters) skills.
2. Connection (of machine terminals) skills.

List of Practical: (At least Eight Experiments are to be performed)

1. a) To measure the slip of 3-phase induction motor by – (i) Stroboscopic method, (ii) Tachometer.
   b) To reverse the direction of rotation of 3-phase induction motor.
2. To perform No-load test and Blocked-rotor test on 3-phase induction motor & draw the equivalent circuit from the two tests.
3. To perform the load test on 3-phase induction motor and to study the performance characteristics of the motor.
4. To control the speed of 3-phase Induction motor by– (i) Frequency changing method, (ii) Pole-changing method.
5. To start a 3-phase Slip-ring induction motor by rotor resistance starter and determine the effect of the rotor resistance on the torque-speed curves of an induction motor.
6. To observe the effect of excitation and speed on induced e.m.f of a 3-phase alternator and plot the O.C.C. of the alternator.
7. To find the percentage regulation of 3-phase alternator by synchronous impedance method at various power factor and load.
8. To synchronise two 3-phase alternator for parallel operation by **-** a) Three lamp method, b) Synchroscope & to study the sharing of load between the alternators.

9.	To list and explain various starting methods of 3-phase synchronous motor and applying any one of them to start the synchronous motor. Plot V-curve & inverted V-curve of the same motor.
10.	To study the effect of capacitor on the starting and running condition of a single-phase Induction motor, and to determine the method of reversing the direction of rotation.

Text books:

Sl No.	Titles of Book	Name of Author	Name of Publisher
1.	Electrical Machines	S.K.Bhattacharya	T.M.H Publishing Co. Ltd.
2.	Electrical Machinery	Dr. S.K.Sen	Khanna Publisher
3.	Electrical Machines	J.B.Gupta	S.K.Kataria & Sons.
4.	The performance and design of Alternating Current machines	M.G.Say	C.B.S Publishers & Distributors
5.	Electrical Machinery	P.S.Bhimbra	Khanna Publisher
6.	Electrical Technology- Vol-II	B.L.Thereja	S.Chand
7.	Electrical Machines	M.N.Bandyopadhyay	P.H.I. Pvt. Ltd.
8.	Electrical Machines	Ashfaq Husain	Dhanpat Rai & Co.
9.	Principles of Electrical Machines and Power Electronics	P.C.Sen	Wiley India
10.	Electrical Machines-I	K.Krishna Reddy	Scitech Publication (India) Pvt. Ltd.
11.	Electrical Machines	Nagrath & Kothari	T.M.Hill
12.	Electrical Technology	H.Cotton	C.B.S. Publisher New Delhi
13.	Electrical Machines	S. Ghosh	Pearson Publisher
14.	Electrical Machines	M.V.Deshpande	PHI

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 4,5	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	2,3,6	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fourth Semester. **Distribution of marks: Performance of Job – 15, Notebook (Drawing) – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fourth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 35, Viva-voce – 10.**

Name of the Course: Electrical Measurement & Control	
Course Code: EE/S4/EMC	**Semester: Fourth**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks
Tutorial: hrs./week	Assignment & Quiz: 10 Marks
Practical: 2 hrs./week	End Semester Exam.: 70 Marks
	Practical : 50 Marks
Credit: 4(Four)	

Aim:

Sl. No.	
1.	Electrical power system, Electrical machine control, Industrial process control and many other systems such as Biomedical, environmental, defence etc. nowadays use sophisticated instruments and their related systems for fast, accurate and reliable measurements, operations and control.
2.	Being Electrical Diploma Holders has a role of supervisor, Maintenance engineer and to assist in carrying out testing and R & D work in electrical, Industrial, Electronics and communication field.
3	He must understand the basics, facts, concepts and principles of various modern Instruments and control system.

Objective:

Sl. No.	The students will be able to:
1.	Identify the components of Instrumentation system for processing given Input to get desired Output.
2.	Identify appropriate transducers/sensors for given application and to know how to use them.
3.	Identify basic signal conditioning circuit components for Instrumentation system in Industrial process, Electrical power system, Electrical machine operation, Measurement and control.
4.	Identify the digital instruments and display devices for various applications.
5.	Understand basic control system theory, stability concept
6.	Understand basics of P, PI, PD system and their application in real system.

Pre-Requisite:

Sl. No.	
1.	Basic knowledge of Applied Electronics, Circuit theory, Electrical machines.

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Transducers:** 1.1 Concept of Transducers 1.2 Classification of Transducers Primary and Secondary Transducers, Electrical and Mechanical Transducers, Analog and Digital Transducers, Active and passive Transducers 1.3 Construction, working principle and application (with diagram & explanation) of following transducers: 1.3.1 RTD, Thermistor, Thermocouple. 1.3.2 Potentiometer (various types) 1.3.3 strain gauge (No derivation only formula) Types of strain gauges, Bridge circuit for strain gauge, application in load & Torque measurement 1.3.4 Bourden tube, Bellows, Diaphragm. 1.3.5 LVDT and RVDT, measurement for displacement. 1.3.6 Capacitive transducers, Application in pressure measurement. 1.3.7 Piezoelectric transducer, load cell. 1.3.8 Contacting and non contacting tachometer, speed measurement 1.3.9 Electromagnetic and turbine flow meter.	15	20
Unit: 2	**Signal conditioning:** 2.1 Concept of signal conditioning. 2.2 Block diagram of AC and DC signal conditioning and working. 2.3. V to I converter, I to V converter, V to F converter. 2.4 Instrumentation Amplifier. 2.5 Filters - Types and frequency response (No derivation) and circuits. 2.6 Multiplexing – Fundamentals, different types.	06	10
Unit: 3	**Digital instruments and Display Devices** 3.1 Digital display devices (LED, seven segment only) 3.2 Concept of 3 ½ ,4 ½ digit. 3.3 Digital voltmeter- Integrating type, Successive approximation. 3.4 Digital frequency meter. 3.5 C.R.O. – Block diagram representation & operation, applications (observation & measurement of voltage, current, phase difference & frequency)	07	10
Unit: 4	**Pilot Devices** 4.1 Pilot Devices - Definition of pilot devices, Function of pilot devices. List of different pilot devices. 4.2 – Construction, working and applications of: Push Button, Limit Switch, Float Switch, Electromagnetic Relay, Pressure switch, Thermostats plugging switch, Proximity switch.	05	10

Unit: 5	**Control System:** 5.1 Introduction to control system, classification of control system, Feedback control system 5.2 Properties of control system: idea on stability, steady state and transient error. (no mathematical deduction) 5.3 Control system components: Synchro, D.C Servomotor, A.C. Servo motor, A.C. Tachometer (only basic operating principle & construction and diagram, no deduction) 5.4 Concept of transfer function, poles and zeroes, transfer function of first & second order system (no deduction), time response characteristics of first and second order system to unit step excitation (no deduction). 5.5 Block diagram representation of control system, Transfer function from Block diagram reduction technique, Signal flow graph. Application of Mason gain formula (maximum two non touching loops). 5.6 Stability concept: characteristic equation, Deciding stability from pole zero concept, Routh criteria. **(Numerical)** 5.7 Control action of a system with ON/OFF, P, PI, PD, PID controller, Practical application of these controllers (with block diagram only).	15	20
Total		**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Interpret results ii) Calculate values of various components for given circuits. ii) Select Instruments
2.	Motor Skills: i) Connect the instruments properly. ii) Take accurate readings. iii) Draw phasor diagram and graphs.

List of Laboratory Experiments:

Sl. No.	**Laboratory Experiments: (At least eight experiments are to be performed)**
1.	To measure Linear displacement by LVDT & plot characteristics.
2.	To measure displacement by Strain gauge & plot characteristics.
3.	To measure temperature by pt-100, thermistor and thermocouple along with simple resistance bridge.
4.	To plot characteristics of potentiometer and observe the loading effect on output of potentiometer.
5.	To study the following signal conditioning circuits and observe and plot the output (i) V to I Converter, (ii) I to V Converter, (iii) V to F Converter using Op-AMP 741.
6.	To measure angular speed by contact type, non- contact type tachometer, Digital Tachometer, Proximity sensor.
7.	To plot frequency response of Active filters (any two):- I) Low pass filter II)High pass filter III) Band pass filter Iv) Band stop filters.

8.	To study the principle of operation and connection of pilot devices like – Push Button Switch, Limit Switch, Selector switch, Pressure switch, Float switch.
9.	To measure voltage, current and Phase difference and Frequency using CRO.
10.	To study open loop control of any physical control system and study of closed loop control of the same system using P, PI and PID controller.
11.	To study the position control system using servomotor.
12.	To study the operation of an instrumentation amplifier using OPAMP.

Text Books

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1.	A.K.Sawhney	Electrical and Electronics Measurement and Instrumentation	Dhanpat Rai & Co.
2.	H.S.Kalsi	Electronic Instrumentation	Tata McGraw Hill
3.	D.Patranabis	Principles of Industrial Instrumentation	Tata McGraw Hill
4.	A.K.Sawhney	Process control & instrumentation	Dhanpat Rai & Co.
5.	Donald P. Eckman	Industrial Instrumentation	Wiley Eastern Ltd.
6.	B.C.Kuo	Automated Control Systems	Wiley India
7.	Nagrath Gopal	Control System Engineering	New Age International
8.	R. Anandanatarajan, P.Ramesh Babu	Control System Engineering	Scitech Publication (India) ltd.
9.	S.K. Bhattachrya Brijinder Singh	Control of Electrical Machines	New Age International
10.	K.Lal Kishore	Electronic Measurement and Instrumentation	Pearson
11.	M.Gopal	Control Systems Principles and Design	McGraw Hill Education (India) Pvt.Ltd

E X A M I N A T I O N S C H E M E (THEORITICAL)

<table>
<tr><th rowspan="2">GROUP</th><th rowspan="2">UNIT</th><th colspan="4">ONE OR TWO SENTENCE ANSWER QUESTIONS</th><th colspan="4">SUBJECTIVE QUESTIONS</th></tr>
<tr><th>TO BE SET</th><th>TO BE ANSWERED</th><th>MARKS PER QUESTION</th><th>TOTAL MARKS</th><th>TO BE SET</th><th><u>TO BE ANSWERED</u></th><th>MARKS PER QUESTION</th><th>TOTAL MARKS</th></tr>
<tr><td>A</td><td>1</td><td>7</td><td rowspan="3">TWENTY</td><td rowspan="3">ONE</td><td rowspan="3">1 X 20 = 20</td><td>FOUR</td><td rowspan="3">FIVE, TAKING AT LEAST ONE FROM EACH GROUP</td><td rowspan="3">TEN</td><td rowspan="3">10 X 5 = 50</td></tr>
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<tr><td>C</td><td>5</td><td>7</td><td>FOUR</td></tr>
</table>

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fourth Semester. **Distribution of marks: Performance of Job - 15, Notebook - 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fourth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job - 15, Viva-voce - 10.**

Name of the Subject: Transmission and Distribution of Power	
Subject Code: EE/S4/TDP	**Semester: FOURTH**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs./Week	Mid Semester Exam.: 20 Marks
Tutorial: nil	Assignment & Quiz: 10 Marks
Practical: 2 Hrs./Week	End Semester Exam.: 70 Marks
Credit: 04	Practical Exam.: 50 Marks

Aim:

Sl. No.	
1.	Electrical diploma pass outs should know systems for electrical energy transmission & distribution. They also will be able to identify various components & their functions.
2.	They will be able to measure system performance. They will be able to deal with various aspects of transmission and distribution system at different stages including erection and maintenance. Hence he should be well acquainted with the materials required and the methods employed for erection and maintenance.
3.	On completion the study of transmission & distribution, he/she will be able to work as technician/supervisor in power industry, manufacturing industry & public utilities.

Objective:

Sl. No.	Student will be able to:
1.	Interpret various types of transmission & distribution systems.
2.	Identify various components & Know their functions.
3.	Calculate voltage regulation & efficiency of transmission system.
4.	Calculate voltage drop of distribution system.

Pre-Requisite:

Sl. No.	
1.	Basic Electrical Engineering.
2.	Electrical Power Generation

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Basics Of Transmission**: 1.1 Layout of a Power System by single line concept. 1.2 Concept of Primary & Secondary transmission & distribution. 1.3 Advantages and limitations of using high voltage for power transmission. 1.4 Comparison between AC & DC power transmission systems. 1.5 Kelvin's laws for the economic choice of conductor size – related problem.	04	4
Unit: 2	**Transmission Line Components:** 2.1 Main components of Overhead lines (names & functions only). 2.2 Types of conductors-Copper, Aluminum & state their trade names. 2.3 Solid, Stranded & bundled conductors.	12	16

	2.4 types of supports – RCC/PCC poles, steel tower 2.5 Comparison between single circuit and double circuit design 2.6 conception of ground wire. 2.7 Line insulators – requirements, types, and field of applications. 2.8 failure of insulators, creepage distance (definition & significance only) 2.9 Distribution of potential over a string of three suspension insulators. --- Problems. 2.10 Concept of string efficiency, Methods of improving string efficiency. ---- Problems. 2.11 Corona – corona formation, advantages & disadvantages, factors affecting corona, important terms related to corona. 2.12 Calculation of Span length & sag Calculation , effect of wind pressure, temperature and ice deposition----- Problems. 2.13 Stringing chart and its uses. 2.14 Spacing of conductors, length of span, Relevant I.E. Rules.		
Unit: 3	**Tansmission Line Parameters:** 3.1 R,L & C of 1-ph & 3-ph transmission line & their effects on line.(No deduction and Problems) 3.2 Skin effect, proximity effect & Ferranti effect. 3.3 Concept of transposition of conductors & necessity.	03	3
Unit: 4	**Underground Cables:** 4.1 Classification of cables and Comparison with overhead lines. 4.2 Cable construction. 4.3 Description of (i) PVC, (ii) PILC (iii) FRLS (Fire Retardant Low Smoke), (iv) XLPE cables & (v) Gas filled (SF6) cables 4.4 Cable Rating and De-rating factor. 4.5 Cable laying	04	7
Unit:5	**Performance Of Transmission Line:** 5.1 Classification of transmission lines. 5.2 Losses, Efficiency & Regulation of line. 5.3 Performance of single phase short transmission line(Numerical based on it) 5.4 Effect of load power factor on performance. Power Factor Improvement Using Static condenser and Synchronous condenser – related problems. 5.5 Medium transmission lines-End condenser, Nominal T & Nominal Pi Network with vector diagram.---- no problem.	09	15
Unit:6	**Extra High Voltage Transmission:** 6.1 EHVAC Transmission, Reasons for adoption & limitations. 6.2 Regional Grid System (Conception only). 6.3 Concept about FACTS and its applications. 6.4 HVDC Transmission – Advantages, Limitations. 6.5 Discussion on few HVDC system in Indian scenario.	03	5

Unit:7	**Components of Distribution System:** 7.1 Introduction. 7.2 Classification of distribution system. 7.3 A.C distribution. 7.4 Connection schemes of distribution system. 7.5 Requirements of Distribution systems. 7.6 Design consideration. 7.7 A.C. distribution calculations. 7.8 Methods of solving A.C.-1 phase & 3 Ø -phase connection (balanced) distribution system. (Numericals based on 1-ph & 3-ph balanced distribution system)	08	12
Unit:8	**Substations:** 8.1 Introduction. 8.2 Classification of indoor & outdoor sub-stations. 8.3 Advantages & Disadvantages. 8.4 Selection & location of site. 8.5 Main connection schemes. 8.6 Equipments and circuit element of substations – their symbols & function. 8.6.1 Bus bar's material, types in detail. 8.6.2 Connection diagram and layout of sub-stations with proper notation.	05	8
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	**Intellectual Skills:** 1.1 Identification & selection of components. 1.2 Making proper connections
2.	**Motor Skills:** 2.1 Ability to measure various parameters. 2.2 Ability to follow standard test procedures.
LIST OF	**EXPERIMENTS : (At least Eight Experiments are to be performed)**
	3.1 To demonstrate the improvement of P.f. using static condenser.
	3.2 To demonstrate various system faults by D.C. network analyzer.
	3.3 To study active and reactive power flow through transmission lines.
	3.4 To study the supply system of 6.6 KV/400V sub-station to a housing complex using slides/model.
	3.5 To study various types of turbine used in Power station using slides/models.
	3.6 To study different types of excitation system for alternator using slides/models.
	3.7 To study different kinds of insulators (Insulators are required to be available in laboratory)
	3.8 To study PILC, PVC, FRLS and XLPE cables. (Cables are required to be available in laboratory)
	3.9 To measure Solar Radiation with the help of Pyranometer.
	3.10 To demonstrate the photo voltaic system used in street lighting – PV module, CCU, Battery, CFL.
	3.11 To study power generation by wind power – using model / slides.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
V. K. Mehta	Principles of power system		S. Chand & Company
SoniGupta-Bhatnagar	A Course in electrical power		Dhanpat Rai
J. B. Gupta	Transmission & distribution of electrical energy		S.K. Kataria & Sons.
Nagsarkar & Sukhija	Power System Analysis		Oxford University Press
Tarlok Singh.	Transmission & Distribution of Power		S.K. Kataria & Sons.
Dr. K.Uma Rao	Power System Operation and Control		Wiley-India
A. T. Starr	Generation, Transmission and Utilization of Electric Power		Pitman
C.L.Wadhwa.	Electrical Power System		Wiley Eastern Ltd

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE taking at least THREE from each Group	TEN	10 X 5 = 50
B	5,6,7,8	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fourth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the course : Applied and Digital Electronics	
Course Code : EE/S4/ADE	**Semester : Fourth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:

Sl. No.	
1.	It intends to teach the operating principles and applications of different types of Amplifiers and Oscillators.
2.	The subject also includes the Basic Digital logic circuits and their applications, D/A & A/D converters etc.
2.	Understanding of the subject will provide skill to the students for trouble shooting & testing of some basic Amplifier circuits, Oscillator circuits and Digital logic circuits.

Objective:

Sl. No.	Student will be able to:
1.	Illustrate the Amplifier circuits and Oscillator circuits.
2.	Describe the Digital logic circuits, Flip-flop, Counter, Register, D/A & A/D converter.
3.	Test the Amplifier circuits, Oscillator circuits and Digital logic circuits.

Pre-Requisite:

1.	Knowledge of Basic Electronics.
2.	Knowledge of Analog & Digital Electronics.

Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. Amplifiers:** **1. Power Amplifiers:** 1.1.1 Classification of power amplifiers – Class-A, Class-B, Class-AB, Class-C operation, Advantage & disadvantages of these amplifiers. 1.1.2 a) Operation of Class-A Push-pull amplifier. b) Operation of Class-B Push-pull amplifier. c) Operation of Class-AB Push-pull amplifier. **1.2 FET Amplifier:** 1.2.1 Biasing methods of FET. 1.2.2 Common-Source amplifier - working principle & applications. 1.2.3 Introduction to MOSFET – Types of MOSFET, construction, working principle and applications. 1.2.4 CMOS – construction and application. frequency. **1.3 Operational Amplifier:** 1.3.1 Basic differential amplifier circuit using BJT. 1.3.2 Pin diagram of OPAMP IC741& functions of each pin. Definition of offset voltage, input bias current, input offset current, differential mode gain, CMRR, slew rate 1.3.3 OPAMP as Non-inverting and Inverting amplifier, Adder, Subtractor, Integrator, Differentiator, Unity Gain Buffer, Schmitt Trigger, Zero Crossing Detector. 1.3.4 Instrumentation amplifier – Operating principle using OPAMP, Applications.	**10**	**16**
Unit : 2	**2. Feedback Amplifiers & Oscillators:** 2.1 Theory of Positive & Negative feedback. 2.2 Types of negative feedback amplifiers –shunt-voltage, series-voltage, shunt-current, series-current feedback. 2.3 Introduction to oscillator, Block diagram of sine wave oscillator, requirement of oscillation, Barkhausen criterion. 2.4 Wien bridge oscillator, Colpitt oscillator – operating principle, frequency of oscillation.	**08**	**14**

Unit : 3	**3. Boolean Algebra & Combinational Logic Circuits:** 3.1 Number Systems – Decimal, Binary, Octal, Hexadecimal, BCD number system & their inter-conversion. 3.2 Symbolic representation & Truth tables for logic gates - NOT, OR, AND, NAND, NOR, XNOR, XOR. 3.3 Rules & laws of Boolean algebra, Demorgan's Theorems. 3.4 Max. term & Min. term, Simplification of Boolean expression using karnaugh map (upto 4 variable). 3.5 Realisation of Boolean expression with Logic gates. 3.6 Half adder, Full adder, Half subtractor, Full subtractor, Parity Generator and checker, Digital comparator 3.7 Code converter, Encoder, Decoder, Multiplexer, Demultiplexer	**08**	**14**
Unit : 4	**4. Sequential Logic Circuits:** 4.1 Flip-flops – RS, D, T, JK, JK Master Slave Flip Flops using basic gates, preset and clear signals. 4.2 Counters - Asynchronous & Synchronous Counter, Mod-N counter, Up Down Counter, Ring counter, 4.3 Registers - Shift register, Serial in Serial out, Serial in Parallel out, Parallel in serial out, Parallel in Parallel out.	**10**	**14**
Unit : 5	**5. Data Converters & Memory Devices:** 5.1 D/A Converter: Basic concepts, Weighted Resistor D/A converter, R-2R Ladder D/A converter. 5.2 A/D Converter: Successive approximation method, Dual slope method. 5.3 Concept of - Static Memory & Dynamic Memory, SDRAM, DDR RAM, PROM, EEROM, EPROM. 5.4 Comparison of Logic families – DTL,TTL and ECL Gates	**12**	**12**
	Total	**48**	**70**

Practical:

Skills to be developed:

Intellectual Skills:

1. To locate the faults in circuits.

2. Interpretation of circuits & corresponding waveforms.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to interpret the circuits.
List of practicals:
1. Applied Electronics: (At least Three Experiments are to be performed) :
1.1 To study RC phase shift oscillator and find out frequency of oscillation.
1.2 To study Colpitt's oscillator and find out frequency of oscillation.
1.3 To plot frequency response of FET amplifier.
1.4 To construct Adder, Subtractor, Unity gain buffer circuit using OPAMP.
2. Digital Electronics: (At least Five Experiments are to be performed)
2.1 To realize OR, AND, NOT and XOR gates using Universal gates.
2.2 To realize Half Adder / Full Adder/ Full Subtractor.
2.3 To verify the function of SR, D, JK and T Flip-flops.
2.4 To implement Encoder and Decoder circuit.
2.5 To implement Multiplexer and Demultiplexer circuit.
2.6 To construct binary Asynchronous or Synchronous counter.
2.7 To construct controlled shift register & verify SISO, SIPO, PISO, PIPO operation.
2.8 To demonstrate D/A converter using trainer kit.
2.9 To demonstrate A/D converter using trainer kit.
List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	Albert Malvino & D.J.Bates	Electronic Principles	T.M.Hill
2.	Y.N.Bapat	Electronic Circuits & Systems	T.M.Hill
3.	R.S.Sedha	Applied Electronics	S.Chand & Co.
4.	Allen Mottershed	Electronic Devices & Circuits	P.H.I. Pvt. Ltd.
5.	J.B.Gupta	Electronics Engineering	S.K.Kataria & Sons.
6.	P.John Paul	Electronic Devices & Circuits	New Age International

7.	Chereku & Krishna	Electronic Devices & Circuits	Pearson Education
8.	Malvino & Leach	Digital Principles & Applications	T.M.Hill
9.	Jain	Modern Digital Electronics	T.M.Hill
10.	V.Kumar	Digital Technology	New Age Publisher
11.	S.P. Bali	2000 solved problems in Digital Electronics	T.M.H
12	M. Moris Mano	Digital Logic and Computer Design	Pearson
13	Khan & Khan	Digital Logic Design	Scitech Publication (India) Ltd.
14.	G.K. Karate	Digital Electronics	Oxford University Press

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
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B	4,5	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fourth Semester. **Distribution of marks: Performance of Job – 15, Notebook (Drawing) – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fourth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Course: Computer aided Electrical Drawing	
Course Code: EE/S4/ED	**Semester: Fourth**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	**Practical : 50 Marks**
Tutorial:	
Practical: 03 hrs/week	
Credit: 02	

Aim:	
Sl. No.	
1.	Students will be able to be able to know various commands of AutoCAD.
2.	Electrical Drawing indicates the symbolic representation and position of components. It also shows the power flow through them for a given systems. Ability to draw, read and understand the drawing will facilitate the visualization of the complete installation which makes it easy to troubleshooting, maintenance of the system.

Objective:	
Sl. No.	The students will be able to,
1.	Read electrical drawing for any system to understand the working of the system and its components.
2.	Find the important points in the circuit diagrams or layout for troubleshooting and maintenance.
3.	Use graphic software to draw the circuit for various types of electrical systems.

Pre-Requisite:	
Sl. No.	
1.	Basic Electrical Engineering
Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Analytical Skill ii) Identification skill
2.	Motor Skills: i) Operate various parts of computer properly. ii) Problem solving skill.

Contents	
Sl. No.	
1.	**CAD** : Necessity and its application in Engineering Field
2.	**Awareness of commands :** Limit, zoom, pan, line, circle, polyline, multiline, arc, text, dimension, hatch, layer, offset, trim, extend, erase, scale, dist, area, fillet, chamfer, array, block, attribute etc.
3.	To draw a sheet of a sample figure (to be provided by the subject teacher) using different **edit/modify option of CAD**
4.	To draw a sheet of electrical symbols for representation of Electrical machines, Equipments, accessories, switching and protection equipment as per IS 2032 **using CAD.**

5.	To draw electrical wiring with accessories on a single storied building (3 BHK) plan, showing Energy meter, Main switch, Distribution Board, Light points, Socket outlets **using CAD.**
6.	A three phase induction motor is to be started and stopped using star delta starter. Draw i) Schematic diagram for the control circuit, ii) power circuit, iii) Complete wiring diagram **using CAD.**
7.	A three phase induction motor is to be started and stopped direct on line (D.O.L.) from different locations through push buttons such that the motor can be started from one location and stopped from other location or vice versa. Draw i) Schematic diagram for the control circuit, ii) Complete wiring diagram (showing overload and short circuit protection) **using CAD.**

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Sham Tickoo & Shafali Pandita	AutoCAD Electrical 2010 for Engineers		Pearson
Goutam Pohit & Goutam Ghosh	Machine Drawing with Auto CAD		Pearson
Surjit Singh	Electrical Engineering Drawing (Part I & Part II)		S.K.Kataria & Sons
Onstolt	AutoCad 2012 and Autocad LT 2012		Wiley India
K. Venugopal, V.Prabhu Raja	Computer aided drafting & modelling		Scitech Publication (India) Pvt. Ltd.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fourth Semester. **Distribution of marks: Performance of Job – 15, Notebook (Drawing) – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fourth Semester on the entire syllabus. One Sheet per student from any one of the above is to be drawn. Sheet is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Course: Power Plant Engineering	
Course Code: EE/S4/PPE	**Semester: Fourth**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory: 4 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical:	End Semester Exam.: 70 Marks
Credit: 04	

Aim:

Sl. No.	
1.	This is a core technology subject. The knowledge of the principle of generation of electricity, methods of generation of electricity & recent trends in generation of electricity is essential for Diploma Engineer.
2.	This subject will provide the basis for further studies in transmission, distribution and power system operation. Also the subject will provide the knowledge about the recent trends in non conventional energy sources & their working principles.

Objective:

Sl. No.	The student will be able to:
1.	Explain the working of different power plants
2.	Identify different components of various systems in generating stations
3.	Select suitable sites for different power stations
4.	Define the terms used in economics of power generation and explain their relation
5.	Select alternative energy sources for given conditions
6.	Explain the working of wind mills and solar systems
7.	Explain working of domestic & commercial D. G. Set
8.	Explain working of Gas Turbine

Pre-Requisite:

Sl. No.	
1.	Energy conversion

Contents		Hrs./Unit	Marks
Unit: 1	1.1 **Basics of Power Generation** 1.1 Importance of electrical power in day today life 1.2 Different forms of energy 1.3 Comparison of sources of energy 1.4 Power crisis in India and Future Trend 1.5 Overview of method of electrical power generation	02	3
Unit: 2	**Thermal Power Stations** 2.1 List of thermal power stations in the state with their capacities 2.2 Selection of site for thermal power stations. 2.3 Layout and working of thermal power station	08	8

	with block diagram. 2.4 Operation of following components: 2.4.1 Boiler 2.4.2 Economizer. 2.4.3 Air pre heater 2.4.4 Super-heaters & re-heaters. 2.4.5 Steam prime movers. 2.4.6 Condensers. 2.4.7 Spray ponds & cooling towers. 2.5 Quality of fuel and its effect on quality of power generation. 2.6 Merits and demerits of Thermal Power Plants. 2.7 Simple Problems.		
Unit: 3	**Nuclear Power Stations** 3.1 Selection of site for Nuclear Power plants. 3.2 Nuclear fission process 3.3 Block diagram and working of Nuclear Power station. 3.4 Construction and working of nuclear reactor. 3. 5 Fuels used in Nuclear Power Station 3. 6 Merits and demerits of Nuclear Power Plants 3. 7 List of Nuclear power stations in state & county with their capacities.	06	7
Unit: 4	**Hydro Power Stations** 4.1 Selection of site and classification of Hydro-electric Power Plants 4.2 Layout and working of Hydro Power Station. 4.3 Types of Turbines & generators used 4.4 Pumped storage Power Plant 4.5 Merits and demerits of Hydro Power Station 4.6 List of Hydro Power stations with their capacities & number of units in the state. 4.7 Simple Problem.	06	7
Unit: 5	**Diesel Electric Power Stations** 5.1 Selection of site for Diesel Electric Power Station. 5.2 Elements of diesel Electric power plants and their working. 5.3 Operation, maintenance & trouble shooting chart of diesel Electric plant. 5.4 Merits, demerits and applications of diesel electric power stations 5.5 Performance and thermal efficiency of Diesel Electric Power Plant.	06	5
Unit :6	**Gas Turbine Power Plants** 6.1 Selection of site for Gas Turbine Power Station. 6.2 Fuels for gas turbine 6.3 Elements of simple gas turbine power plants 6.4 Merits, demerits and application Gas turbine power plants.	03	5
UNIT:7	**Non-Conventional Energy Sources** 7.1 Types of non-conventional energy sources. 7.2 Solar Energy 7.2.1 Potential of solar energy. 7.2.2 Solar collector (Flat Plate Collector & Concentrating Collector) 7.2.3 Comparison of performances of	20	20

	different collectors. 7.2.4 Solar water heater. 7.2.5 Solar Thermal Power Plant - System block diagram with description & efficiency. 7.2.6 Photovoltaic cell : Principle of operation, Types, conversion efficiency, V-I characteristics. 7.2.8 Solar Cell Materials. 7.2.9 Photovoltaic system of power generation – Solar PV arrays, solar cell connecting arrangements, storage batteries, inverters, advantages & disadvantages. 7.2.11 Limitation of using solar energy systems. 7.3 Wind Energy. 6.3.1 Selection of site for wind mills 6.3.2 Principle of electricity generation with the help of wind energy 6.3.3 Block diagram and working of Wind energy plant and its applications 6.3.4 List of major wind farms in the state with their approximate capacities 7.4 Brief idea and application of i) Bio Mass and bio gas energy. ii) Geothermal Energy.		
Unit: 8	**Economics Of Power Generation** 8.1 Terms commonly used in system operation: connected load, firm power, cold reserve, hot reserve, spinning reserve. 8.2 Terms used in system operation such as Load-curve, load duration curve, integrated duration curve. (Simple numerical based on plotting above curves.) 8.3 Factors affecting the cost of Generation: Average demand, Maximum demand, plant capacity factor & plant use factor, Diversity factor& load factor. (Simple numericals based on above)	08	08
Unit : 9	**Interconnected Power Systems** 9.1 Advantages of Interconnection. 9.2 Base load & peak loads, load allocation among various types of power stations 9.3 Load sharing and transfer of load between power stations. 9.4 Inter connection of power stations at state and national level	05	07
	Total	64	70

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
J.B.Gupta	A course in Power System		S.K.Kataria & Sons
Umesh Rathore	Energy Management		S.K.Katharia & Sons
Dr. R.KSingal	Non-conventional Energy		S.K.Katharia & Sons

	Resources		
Dr. S. L. Uppal	Electrical Power		Khanna Publishers.
Soni – Gupta - Bhatnagar	A course in Electrical Power		Dhanpatrai & Sons
Prof. G. D. Rai	Non conventional Energy sources		Khanna, New Delhi
A.K.Raja,M. Dwibedi & A.P.Srivastava	Introduction to Non conventional Energy sources		Scitech Publication (India) Pvt. Ltd.
Prof. Arrora and Dr. V. M. Domkundwar	A course in Power Plant Engineering		Dhanpatrai & Sons
K.K. Ramalingam	Power Plant Engineering		Scitech Publication (India) Pvt. Ltd.
S P Sukhatme	Solar Energy		Tata Mc Grawhill Publishing co. Ltd.
Godfrey Boyle	Renewable Energy		Oxford University Press
P.K.Nag	Power Plant Engineering		T.M.H.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4,5,6	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	7,8,9	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

Name of the Course: Development of Life Skills - II	
Course Code: EE/S4/DLSII	**Semester: FOURTH**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory: 01 hrs / week	Internal Sessional: 25
Tutorial:	External Sessional : 25
Practical: 02 hrs / week	
Credit:	

Aim:

Sl. No.	
1.	In today's competitive world, the nature of organizations is changing at very rapid speed. In this situation the responsibility of diploma holder is not unique. He will be a part of a team in the organization. As such the individual skills are not sufficient to work at his best.
2.	This subject will develop the student as an effective member of the team. It will develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team.
3.	Such skills will enhance his capabilities in the field of searching, assimilating information , managing the given task, handling people effectively ,solving challenging problems .

Objective:

Sl. No.	**The students will be able to:**
1.	• Developing working in teams.
2.	• Apply problem solving skills for a given situation.
3.	• Use effective presentation techniques.
4.	• Apply techniques of effective time management.
5.	• Apply task management techniques for given projects.
6.	• Enhance leadership traits.
7.	• Resolve conflict by appropriate method.
8.	• Survive self in today's competitive world.
9.	• Face interview without fear.
10.	• Follow moral and ethics.

Pre-Requisite:

Sl. No.	
1.	Team Work and Presentation Skills
2.	Positive attitude and thirst of learning

	Contents	Hrs./Unit	Marks
Unit - 1	**Interpersonal Relation** Importance, Interpersonal conflicts, Resolution of conflicts, Developing effective interpersonal skills - communication and conversational skills, Human Relation Skills (People Skills)	5	

Unit - 2	**Problem Solving** **I) Steps in Problem Solving (Who? What? Where? When? Why? How? How much?)** 1. Identify, understand and clarify the problem 2. Information gathering related to problem 3. Evaluate the evidence 4. Consider feasible options and their implications 5. Choose and implement the best alternative 6. Review **II) Problem Solving Technique** 1. Trial and Error, 2. Brain Storming 3. Thinking outside the Box	8	
Unit - 3	**Presentation Skills** Concept, Purpose of effective presentations, ***Components of Effective Presentations*** : understanding the topic, selecting the right information, organising the process interestingly, Good attractive beginning, Summarising and concluding, adding impact to the ending, ***Use of audio-visual aids*** - OHP, LCD projector, White board, ***Non-verbal communication*** : Posture, Gestures, Eye-contact and facial expression, Voice and Language - Volume, pitch, Inflection, Speed, Pause, Pronunciation, Articulation, Language Handling questions - Respond, Answer, Check, Encourage, Return to presentation ***Evaluating the presentation*** - Before the presentation, During the presentation, After the presentation	8	
Unit - 4	**Looking for a Job** Identifying different sources announcing Job vacancies, Skim, scan and read advertisements in detail, write efficacious CVs, write covering letters to accompany CVs, write Job Application Letters - in response to advertisements and self-applications	5	
Unit - 5	**Job Interviews** ***Prepare for Interviews*** : Intelligently anticipating possible questions and framing appropriate answers, Do's and don'ts of an interview (both verbal and non-verbal), ***Group Discussion:*** Use of Non-verbal behaviour in Group Discussion, Appropriate use of language in group interaction, Do's and don'ts for a successful Group Discussion	10	
Unit - 6	**Non-verbal - graphic communication** Non - verbal codes: A - Kinesics, B - Proxemics, C- Haptics, D - Vocalics,	6	

	E- Physical appearance, F- Chronemics, G - Artifacts Aspects of Body Language		
Unit - 7	**Formal Written Skills:** Memos, E-mails, Netiquettes. Business correspondence - Letter of enquiry, Letter of Placing Orders, Letter of Complaint	6	
	Total	**48**	

Sessional Activities	
Sl. No.	Skills to be developed
Unit - 1 Interpersonal Relation	Case Studies: 1. from books 2. from real life situations 3. from students' experiences Group discussions on the above and step by step write of any one or more of these in the sessional copies
Unit - II Problem Solving	Case Studies: 1. from books 2. from real life situations 3. from students' experiences Group discussions on the above and step by step write of any one or more of these in the sessional copies
Unit - III Presentation Skills	Prepare a Presentation (with the help of a Powerpoint) on a Particular topic. The students may refer to the Sessional activity (sl. No. 8) of the Computer Fundamental syllabus of Semester 1. For engineering subject-oriented technical topics the co-operation of a subject teacher may be sought. Attach handout of PPT in the sessional copy
Unit - IV Looking for a job	Write an effective CV and covering letter for it. Write a Job Application letter in reponse to an advertisement and a Self Application Letter for a job.
Unit - V Job Interviews & Group Discussions	Write down the anticipated possible questions for personal interview (HR) along with their appropriate responses Face mock interviews. The co-operation of HR personnels of industries may be sought if possible Videos of Mock Group Discussions and Interviews may be shown
Unit - 7 Formal Written Skills	write a memo, write an effective official e-mail, write a letter of enquiry, letter of placing orders, letter of complaint

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
K. R.Laksminarayanan & T. Murugaval	Managing Soft Skills		Scitech Publications (India) Pvt. Ltd.
Barun K. Mitra	Personality Development and Soft Skills		Oxford University Press

Note : For any modification please refer www.webscte.org/syllabus.html of "Development of Life Skill-II"

Name of the Subject : Professional Practices II		
Course Code: EE/S4/PFII	**Semester: Fourth**	
Duration: one Semester	**Maximum Marks: 50**	
Teaching Scheme	**Examination Scheme**	
Theory:	Mid Semester Exam.: Marks	
Tutorial:	Assignment & Quiz: Marks	
Practical: 2 hrs / week	End Semester Exam.: Marks	
	Practical : 50 Marks	
Credit: 1		

Aim:

Sl. No.	
1.	Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.
2.	While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.
3	The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objective:

Sl. No.	The student will be able to
1.	Acquire information from different sources
2.	Prepare notes for given topic
3.	Present given topic in a seminar
4	Interact with peers to share thoughts
5	Prepare a report on industrial visit, expert lecture

Pre-Requisite:

Sl. No.	
1.	Desire to gain comparable knowledge and skills of various activities in various areas of importance.
2.	Eagerness to cohesively participate in group work and to share thoughts with group members.
3.	Knowledge of electrical engineering upto 4th semester.

Activities

Sr . No.	Activities	Hours
1.	Industrial / Field Visit : Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to **<u>any ONE</u>** (not already visited in 3rd semester) from the list below: i) Electrical machine manufacturing industry ii) Multistoried building for power distribution	**06**

	iii) Load dispatch center iv) Transformer repair workshop. v) Foundry (to see furnaces and oven) vi) Food Processing industry (overall technical and other activities) vii) An industry automation in manufacturing viii) District Industries Centre (to know administrative set up, activities, various schemes etc) ix) Any loco shed x)Signaling system of a railway station xi) Any captive power plant. xii) Motor rewinding in a motor rewinding shop	
2.	**Guest Lecture by professional / industrial expert**: Lectures by Professional / Industrial Expert to be organized from **any TWO of** the following areas: i) Modern concept of lighting / illumination ii) Viability of electric traction in 21st Century iii) Modern techniques in Power Generation iv) Role of power factor improvement as a tool in reducing cost of generation v) Digital metering vi) Hydro power generation vii) Functioning of Electricity regulatory Commission. viii)Introduction and application areas for MEMS (Micro Electromechanical System) ix) Interview techniques x)Free and open source software xi) Cyber crime & Cyber laws xii)Social networking – effects & utilities xiii) Ethical Hacking. xiv) Role of micro, small and mediun enterprise. In Indian economy. Individual report of the above lecture should be submitted by the students.	**4**
3.	**Seminar:** Any one seminar on the topics suggested below: Students (Group of 4 to 5 students) have to search / collect information about the topic through literature survey/ internet search / visit and discussion with expert or concerned persons 1. Water Supply scheme / Problems of drinking water in rural area 2. Schemes of power generation in coming five years 3. Impact of load shedding on rural population 4. Parallel computing 5. Distributed processing 6. Embedded system 7. Computer security 8. Bio – technology	**12**

	9. Multimedia techniques. 10. Magnetic levitation system	
4.	**Students' Activities / mini project:(any one)** i) Collect information from market regarding technical specification, identification no, their meaning, manufacturers' names and cost of electronic devices like diode, zener diode, transistors, JFET, MOSFET, ic 555, ic 741, digital ics (All items studied upto 4th semester). Submit the report along with power point presentation. Students are encouraged to use **open software** ii) Collect information from market regarding specification and cost of items (at least four each) used in electrical wiring for Domestic, commercial and industrial use. They will submit individual report on the same. Students are encouraged to use open software. iii) make a market survey of all transducers available (studied in fourth semester) their specifications, manufacturers' names, cost etc. Prepare a power point presentation. Students are encouraged to use **open software** for such purpose.	**10**

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous internal assessment of 50 marks** is to be carried out by the teachers throughout the fourth semester. **Distribution of marks: Student's activities/mini Project = 20, seminar = 10, field visit = 10, guest lecture attendance and report = 10**

W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTERS

SEMESTER: FIFTH SEMESTER **SCHEME : C**

Sr.No	SUBJECT	PERIODS			EVALUATION SCHEME							Credits
	THEORY				SESSIONSAL EXAM				PR(INT.)	PR (EXT.)		
		L	T	P	TA	CT	Total	ESE				
1	Power Electronics and Drives	03		02	10	20	30	70	25	25		4
2	Microprocessor & Microcontroller	03	--	02	10	20	30	70	25	25		4
3	Switchgear & Protection	03		02	10	20	30	70	25	50		4
4	Industrial Project & Entrepreneurship Development	01	--	03					25	50		3
5	Utilization, Traction , Heating and drives	03		02	10	20	30	70	25	25		4
6	Elective I (Any One)	03	--	02	10	20	30	70	25	25		4
	Illumination Engineering											
	Heating , Ventilation and Air conditioning											
	Energy Conservation & Audit											
	Electric Traction											
7	Professional Practice -III			03					25	25		2
	Total	**16**		**16**	**50**	**100**	**150**	**350**	**175**	**225**		**25**

STUDENT CONTACT HOURS PER WEEK: **32 HRS**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.

Total Marks : 900

Minimum passing for sessional marks is 40%, and for theory subject 40%.

Name of the Subject : Power Electronics & Drives	
Subject Code: EE/S5/PED	**Semester : Fifth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:

Sl. No.	
1.	The field of Electrical Engineering is generally segmented into three major areas – Electronics, Power & Control.
2.	This subject is the combination of these three areas. Nowadays all the industrial drives to run a machine and to control it as per requirement are based on Power Electronics.
2.	Understanding of the subject will provide skill to the students for trouble shooting & testing of Power semiconductor devices, Solid state DC & AC motor drives.

Objective:

Sl. No.	Student will be able to:
1.	Describe the Power semiconductor devices & draw their characteristics.
2.	Describe the Inverter, Converter & Chopper circuits.
3.	Explain the operation of the DC motor & AC motor drives

Pre-Requisite:

1.	Knowledge of Applied Electronics.
2.	Knowledge of DC & AC Motor operation to run their drives.

Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. POWER SEMICONDUCTOR DEVICES:** **1.1 THYRISTOR (SCR)** 1.1.1 Construction, operation & symbol. 1.1.2 V-I characteristics of SCR (Holding current, Latching current, Breakover voltage). 1.1.3 Turn on methods - Voltage triggering, Gate triggering, dv/dt triggering. 1.1.4 Turn off methods – Current reduction, AC line commutation, Forced commutation. 1.1.5 Thyristor specifications – voltage rating, current rating, power rating, dv/dt, di/dt, Gate current, temperature. 1.1.6 Utility of Snubber circuit , Freewheeling diode. 1.1.7 DIAC, TRIAC, SCS – Principle of operation, characteristics & application. 1.1.8 IGBT - Principle of operation, characteristics & application.	**10**	**14**
Unit : 2	**2. Switching & Timer Circuits :** 2.1 Simple transistor timer using R-C as timing element. 2.2 Classification of multi-vibrators. 2.3 Study of Astable, Monostable & Bistable multivibrator	**10**	**14**

	circuits using OPAMP. 2.4 Internal block diagram, Pin diagram and operating of IC 555. 2.5 Study of Astable, Monostable & Bistable multivibrator circuits using IC 555 timer.		
Unit : 3	**3. Converter and Inverter:** **3.1 AC to DC Converter :** 3.1.1 Single phase fully controlled Half Wave Converter - with resistive load, - with R-L load 3.1.2 Single phase fully controlled Full Wave Converter - with resistive load, - with R-L load 3.1.3 Three phase fully controlled Bridge Converter - with RL load 3.1.4 **Cycloconverter –** Principle of operation of Single phase & Three phase cycloconverter, Basic circuit diagram, Input & Output waveforms. **3.2 Inverter :** 3.2.1 Classification of Single phase & Three phase Inverter – Line commutated & Forced commutated Inverters, Series, Parallel, Bridge Inverter 3.2.2 Operation of basic Series Inverter. 3.2.3 Operation of basic Parallel Inverter. 3.2.4 Operation of Single phase Bridge Inverter - a) Half Bridge Inverter b) Full Bridge Inverter 3.2.5 Pulse Width Modulated Inverter – a) Single pulse width Modulated Inverter. b) Multiple pulse width Modulated Inverter. c) Sinusoidal pulse width Modulated Inverter.	**10**	**16**
Unit : 4	**4. DC Chopper:** 4.1 Principles of chopper. 4.2 Classification – a) Step-up & Step-down chopper b) Second quadrant, Two quadrant & Four quadrant operation. 4.3 Type-A, B, C, D chopper – Operating Principle. 4.4 Commutations methods for choppers – Auxiliary commutation, Load commutation. 4.5 Jones chopper.	**08**	**12**
Unit : 5	**5. DC & AC Drives :** 5.1 Speed control of separately excited DC motor by single phase fully controlled converter. 5.2 Speed control of separately excited DC motor with three phase fully controlled converter. 5.3 Speed control of DC series motor with chopper control. 5.4 Speed control of DC servomotor. 5.5 Speed control of Three phase Induction motor with variable frequency PWM VSI. 5.6 Speed control of Three phase Induction motor with variable voltage variable frequency control. 5.7 Speed control of AC servomotor. 5.8 Static VAR compensation system - Principle of operation &	**10**	**14**

	Block diagram. 5.9 Uninterrupted power supply – Principle of operation & Block diagram of On load & Off load type UPS.		
	Total	**48**	**70**

Practical:

Skills to be developed:

Intellectual Skills:

1. Ability to select appropriate devices & instruments.
2. Ability to test & troubleshoot.

Motor Skills:

1. Ability to draw the circuit diagrams.
2. Ability to interpret the circuits and waveforms.

List of Practical: (At least Eight Experiments are to be performed)

1. To fabricate an op-amp integrator, determine its amplitude, phase relation with input, duration of output pulse compared to input for a square wave input.
2. To fabricate an op-amp differentiator, determine its amplitude, phase relation with input duration of output pulse compared to input for a triangular input.
3. To identify the terminals of Thyristor and plot V-I characteristics of Thyristor.
4. To fabricate with IC-555 -

   (a) Astable multivibrator & to determine duration of high pulse, low pulse and duty cycle.

   (b) Monostable multivibrator & to determine the duration of high and low pulses triggered condition with different R-C values.

   (c) A Pulse Width Modulation circuit to observe the variation of duration of high pulse with the various values of control voltage at control input terminal of IC-555.
5. To study fully controlled full wave rectifier using SCR.
6. To study DC chopper circuit using SCR.
7. To study series inverter using SCR.
8. To perform speed control of DC series motor using SCR.
9. To perform speed control of 3-phase Induction motor using PWM inverter. Interpret speed-torque characteristics. Use variable voltage variable frequency drive.
10. To study the operation and circuit diagram of Uninterrupted Power Supply unit.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	M.D.Singh, K.B.Kanchandani	Power Electronics	T.M.Hill.
2.	Mohan, Undeland, Riobbins	Power Electronics	Wiley India
3.	S.N.Singh	Power Electronics	Dhanpat Rai & Co.
4.	V. Subrahmanyam	Electric Drives – concepts & applications	T.M.Hill
5.	Albert Malvino & D.J.Bates	Electronic Principles	T.M.Hill
6.	V.R.Moorthi	Power Electronics	Oxford
7.	G.K.Dubey	Fundamentals of Electric drives	Narosa Publishing House
8.	M.H.Rashid	Power Electronics	P.H.I. Ltd
9.	K.Haribabu	Power Electronics	Scitech Publisher

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	3,4,5	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject: Microprocessor and microcontroller	
Subject Code : EE/S5/MPMC	**Semester: FIFTH**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 2 Hrs/Week	End Semester Exam.: 70 Marks
Credit: 04	Practical : 50 Marks

Aim:

Sl. No.	
1.	Today microprocessors and microcontrollers have become an integral part of all automatic and semi automatic machines. Therefore there is a growing need of engineers / technicians in this field. Hence, it is necessary to study microcontroller basics, hardware and its programming.
2.	This subject covers microprocessor 8085 and microcontroller 8051 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microcontroller and microprocessor based applications.

Objective:

Sl. No.	The student will be able to
1.	Describe architecture and operation of microprocessor 8085
2.	Develop assembly language programs using instruction set of 8085
3.	Describe architecture and operation of microcontroller 8051
4.	Develop assembly language programs using instruction set of 8051
5.	Design and develop microcontroller based systems
6.	Explain various applications of microcontrollers

Pre-Requisite:

Sl. No.	
1.	Knowledge of digital electronics

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Microprocessor Basics** 1.1 Generation and evolution of 4 bit microprocessor to latest microprocessor 1.2 Basic Architecture of 8-bit Microprocessor 1.2.1 Hardware features of Intel – 8085 functional Blocks, bus structure. 1.2.2 Arithmetic Logic Unit 1.2.3 Registers (General purpose & Special Purpose) 1.2.4 Interrupts 1.2.5 Pin description. 1.3 Timing cycles of 8085 – Machine cycle, Opcode fetch cycle, execution cycle, instruction cycle.	8	12

Unit: 2	**Microprocessor Programming** 2.1 Instruction set of Intel 8085 2.2 Addressing modes 2.3 Introducing to branch and subroutine 2.4 Simple Program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion etc. 2.5 Interrupt & Interrupt Service Routine	8	13
Unit: 3	**Application of microprocessor** 3.1 Review of A/D and D/A converter 3.2 Interfacing – parallel (8255) 3.3 Measurement of voltage, current, frequency. 3.4 Generation of square, triangular and staircase waveform. 3.5 Over current Relay operation . 3.6 Speed control of D.C. motor	8	10
Unit : 4	**Microcontroller Basics** 4.1 Introduction and applications 4.2 Comparison between microcontrollers and microprocessors 4.3 Evolution of microcontrollers 4.4 Architecture of 8051 4.4.1 Block diagram of 8051 microcontroller 4.4.2 Registers in 8051 4.4.3 General purpose or working registers 4.4.4 Stack Pointer and Program counter 4.4.5 Special function registers (SFR) 4.4.6 Program Status word 4.4.7 Data pointer (DPTR) 4.4.8 Timer resisters 4.4.9 Ports 4.4.10 Control registers	7	10
Unit: 5	**8051 addressing modes and instructions** 5.1 8051 addressing modes 5.2 8051 instruction set 5.5 8051 Simple Program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion, Hex to ASCII conversion etc.	6	10
Unit : 6	**8051 interrupts, timer/counters** 6.1 Interrupts in 8051 6.2 Initializing 8051 interrupts 6.3 Interrupt priorities 6.4 Timers and counters, timer counter modes	6	7
Unit: 7	**Application of microcontroller** 7.1 Measurement of voltage, current, frequency. 7.2 Generation of square, triangular and staircase waveform. 7.3 Over current Relay operation . 7.4 Speed control of D.C. motor.	5	8

	Total	**48**	**70**

Text Books:

Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1.	Ramesh Gaonkar	Microprocessor Architecture, Programming, and Applications with the 8085	Wiley Eastern Ltd.
2.	B. Ram	Fundamentals of Microprocessor & Microcontroller	Danpat Rai Publication
3.	Kenneth J Ayala,	8051 microcontrollers architecture, Programming and Applications	Penram International Publishing (I) Pvt. Ltd.
4.	Nagoorkani	Microprocessor & Microcontroller	T.M.Hill ,India
5.	N. Senthil Kumar M.Sarvanan S.Jeevananthan	Microprocessors and Microcontrollers	OXFORD University Press
6.	Subhashis Maitra	Microprocessor and microcontroller	J.B. Books and Learning
7.	Naresh Grover	Microprocessor – Comprehensive studies	Dhanpat Rai & Co.
8.	Biju Azeez	Microprocessor interfacing & Microcontroller	Scitech Publication

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Logical development ii) Programming skills
2.	Motor Skills: i) Data entry, Error Correction and Execution of assembly language programms ii) Connection Skills

Suggested list of Laboratory Experiments:

Sl. No.	Minimum 10 Experiments to be conducted from between Sl no. 1-17
I.	1. Introduction of 8085 Microprocessor and 8051Microcontroller Kit 2. To develop and execute the following using 8085 Microprocessor / 8051 Microcontroller **(At least Eight programs)** i) Addition, Subtraction of two numbers. ii) Multi-byte addition. iii) Multiplication of two numbers. iv) Finding the maximum value in an array. v) Arranging the given data in Ascending order. vi) BCD to Hex conversion. vii) Hex to BCD conversion. viii) Hex to ASCII conversion. ix) ASCII to Binary conversion. x) Square Root of a given data. xi) Least Common Multiple of two numbers. xii) Greatest Common Divisor of two numbers. xiii) Program using interrupt.
II.	To develop, Run & Test Program for the following using 8085 Microprocessor / 8051 microcontroller: **(At least Four applications)**
	1. Measurement of dc voltage and currents using suitable potential divider circuit and shunt along with an A/D converter.

	2. Measurement of ac voltage, current, frequency and phase angle difference (either between two voltages or between voltage and current) using suitable PT, CT, Zero crossing detectors, A/D converters etc. 3. Generation of square, triangular, staircase wave form using D/A converter. 4. Over voltage/under voltage or over current/under current relay circuit using suitable hardware circuit. 5. Control of a D.C. motor at different speed and to note speed vs. Load characteristics at open loop condition. 6. Operation of a stepper motor with a fixed number of steps and to determine the angular displacement per step by measuring the total angular rotation. 7. Operation of a stepper motor continuously at different speed. 8. Control of Traffic light.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,7	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

3. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
4. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject : Switchgear and Protection	
Subject Code: EE/S5/SWGRP	**Semester: FIFTH**
Duration: one Semester	**Maximum Marks: 175**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs./Week	Mid Semester Exam.: 20 Marks
Tutorial: nil	Assignment & Quiz: 10 Marks
Practical: 3 Hrs./Week	End Semester Exam.: 70 Marks
Credit: 04	Practical Exam.: 75 Marks

Aim:

Sl. No.	
1.	To study the principles, concepts & procedural aspects of switchgear & protection.
2.	To Identify various components of switchgear & protection systems.
3.	To Identify faults & know how to repair the switchgear.

Objective:

Sl. No.	The student will be able to:
1.	Explain the principles, concepts & procedural aspects of switchgear & protection.
2.	Identify the various components of switchgear & protection systems.
3.	Select switchgear & protection system as per specification

Pre-Requisite:

Sl. No.	
1.	Power system
2.	Fundamentals of AC, DC Machines

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Fundamental:** 1.1Necessity & functions of protective system. 1.2 Normal & abnormal conditions. 1.3 Types of faults & their causes. 1.4 Use of current limiting reactors & their arrangements. 1.5 Short-circuit KVA calculations for symmetrical faults – problems.	06	10
Unit: 2	**Circuit interrupting devices:** 2.1 Basic fuse terminology: fuse element, rated current, fusing current, fusing factor, prospective current, cut-off current, arcing time, rupturing capacity, total operating time. Fuse Characteristics 2.1.1 HRC fuses – construction, types, working, characteristics, selection and applications 2.2 Isolators- vertical break, horizontal break & pentograph type	11	18

	2.3 Arc formation process, methods of arc extinction, related terms. 2.4 Circuit breakers- Concept, Classification, Working principle, Construction, Specification & Applications of 2.4.1 E.H.V/H.V – Minimum oil circuit breakers (M.O.C.B.), Air Blast Circuit Breaker (A.B.C.B),Sulpher Hexa Fluoride circuit breaker (SF6). vacuum circuit breaker**.** 2.4.2 L.V.- Air circuit breakers (ACB),miniature circuit breakers (M C B) , Moulded case circuit breakers (M C C B) , Earth leakage circuit breaker (E L C B or R C CB), Comparison of fuse & MCCB 2.5 Selection of MCCB for motor. 2.6 Selection and rating of circuit breakers - breaking capacity, making capacity, rated operating duty, rated voltage. 2.7 Elementary idea of Auto-reclosing.		
Unit: 3	**Protective Relaying:** 3.1 Zones of protection, primary & back-up protection, Essential qualities of protection, classification of protective schemes, basic relay terminology. 3.2 CT & PT used in protection: Requirements, Basic circuit diagram, working principle & application of CVT and CCVT. 3.3 Operating principles and construction (in brief) of: Electromagnetic relays, thermal relays, static relays (with merits and demerits), and Microprocessor based relays, Auxiliary switch Flags – conception only. **3.4 Over current relay---** Time-current characteristics of definite time, instantaneous, inverse time and IDMT Relays. Use of very inverse-type O/C relay and extremely inverse type O/C relay**.** Time-setting, current-setting, PSM – problems**.** **3.5 Directional Relay -** Introduction, Characteristics : Constant product characteristics, Polar characteristics, Concept of dead zone**.** 3.6 **Distance Protection Scheme :** Area of applications, Impedance relays, Reactance relay, MHO relay : operating characteristics, effect of arc resistance on their characteristics. **3.7 Differential Relay** : Introduction, Current differential protection for an internal fault – fed from single & both end. Voltage balance differential protection – Schematic diagram & operation (in brief). Mention the position	15	18

	of operating coil and the restraining coil for both the cases. 3.**8 Static over current relays** **3.9 µP based over current relays.**		
Unit: 4	**Equipment Protection:** 4.1 **Generator protection** – Percentage differential stator protection, brief idea of: - rotor protection due to loss of excitation, protection against rotor overheating because of unbalance in load, over-speed protection, protection against motoring and field suppression. 4.2 **Transformer protection** - Percentage differential protection – problems, Buchholz Relay, rate of rise of pressure relay, over-fluxing protection, O/C protection. 4.3 **Protection of Motor:** Abnormalities & faults. Short circuit protection, Overload protection, Single phase preventer. 4.4 **Protection of Busbar & transmission line**	11	16
Unit:5	**Over voltage Protection:** 5.1 Causes of over voltages. 5.2 Lighting phenomena & over voltage due to lightning. 5.3 Protection of transmission line & substation from direct stroke. 5.4 Types of lightning arresters & surge absorbers & their Construction & principle of operation. 5.5 Protection against traveling waves. 5.6 Insulation co-ordination.	05	8
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Identify different types of circuit breakers 2. Test the different types of relays. 3. Idea about simulation.
2.	Motor Skills: 1. Simulate circuit configuration. 2. Set the relays for various tests.
3.	**List of Practical: (3.1 and 3.2 are compulsory & any Five from the rest)** 3.1 To demonstrate HRC fuse, MCB & ELCB and explain the functions of various components. 3.2 To Identify the components of following types of circuit breakers with their specifications (through visits , video or model).: I) Low tension air circuit breaker.(including protective devices) II) Minimum oil circuit breaker (M O C B) III) Air Blast circuit breaker (ABCB) IV) Sulpher - Hexa fluoride circuit breaker (S F 6) V) Vacuum circuit breaker.

	3.3 To Plot the inverse characteristics of Induction type/ Micrprocessor Based – (i) O/C relay, (ii) E/F relay using Relay Testing Kit. 3.4 To test percentage Differential Protection of Transformer Using Transformer Differential Relay (Electromagnetic/Microprocessor based). 3.5 To demonstrate the operation of single phasing preventer by creating single phasing fault for a given 3-ph induction motor with D.O.L. starter. 3.6 To test Directional Over Current Relay (DOCR) by Relay Testing Kit. 3.7 To simulate Alternator Protection using any simulator 3.8 To simulate the operation of Distance Relay using any simulator 3.9 To prepare a report on specifications of lightning arresters of different manufacturers through Brochures / Literature

Text Books:

Name of Authors	Title of the book	Edition	Name of the Publisher
J.B.Gupta	Switchgear & Protection		S.K.Katharia & Sons
C.L.Wadhwa	Electrical Power System		Wiley Eastern Ltd.
Badriram & Vishwakarma P.N.	Power System Protection & Switchgear		TMH, New Delhi
B. Bhalja, R.P.Maheshwari & N.G. Chothani	Protection and Switchgear		Oxford University Press
V.K. Mehta & R. Mehta	Principles of Power system		S.Chand & Co. Ltd.
B. Ravindranath, M Chandar	Power System Protection and Switchgear		Wiley Eastern Ltd.
Raghuraman	Protection & Switchgear		Scitech Publication (India) Pvt. Ltd.

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	8	TWENTY	ONE	1 X 20 = 20	THREE	TWO	TEN	10 X 5 = 50
B	3,4	12				THREE	TWO		
C	5,6	4				TWO	ONE		

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 35, Viva-voce – 15.**

Name of the subject: INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT	
Subject Code: EE/S5/IPED	**Semester: S5**
Duration: one Semester	**Maximum Marks: 75**
Teaching Scheme	**Examination Scheme**
Theory: 1 Hrs/week	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 3 Hrs/week	End Semester Exam.: Marks
Credit: 03	Practical : 7 5 Marks

Aim:	
Sl. No.	
1.	It is intended to provide opportunity for students to develop understanding of the interrelationship between different courses learnt in the entire diploma programme and to apply the knowledge gained in a way that enables them to develop & demonstrate higher order skills.

Objective:	
Sl. No.	The student will be able to:
1.	Generate creative ability by developing something which has Engineering relevance
2.	Handle real life problems that a diploma-holder may encounter as a professional
3.	Identify entrepreneurship opportunity
4.	Develop entrepreneurial values and attitude
5.	Use the information to prepare project report for business venture
6.	Develop awareness about enterprise management

Pre-Requisite:	
Sl. No.	
1.	Knowledge of subjects up to 4th Semester of Electrical Engineering.

PART A: Industrial Project

Following activities related to project are required to be dealt with, during this semester

1. Form project batches (Max. 6 students per batch)

2. Each project batch should select topic / problem / work by consulting the guide & / or industry.

(One from Group 1 and another from Group 2)

3. Each project batch should prepare action plan of project activities & submit the same to respective guide.

4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.

5. Action Plan should be part of the project report.

Actual work of project should be done in sixth semester.			
Group	Projects		
1	(1) Design and Estimation of electrification of a modern multistoried building along with the required sub-station complying I.E. Rules. (2) Design of Rural Electrification Scheme for small Village, Colony. (3) Energy Conservation and Audit. (4) Substation Model (Scaled) (5) Wind Turbine Model (Scaled) (6) Pole Mounted Substation Model (Scaled) (7) Conduct load survey to ascertain the total load requirements of a locality / polytechnic. (8) Any other items as may be assigned by the teacher concerned.		
2	(1) Rewinding of Three Phase/Single Phase Induction Motor. (2) Rewinding of Single Phase Transformer. (3) Fabrication of Inverter up to 1000 VA. (4) Fabrication of Battery Charger. (5) Fabrication of Small Wind Energy System for Battery Charging. (6) Fabrication of Solar Panel System for Battery Charging. (7)Fabrication of Water level controller. (8)Fabrication of DC motor speed control circuit by SCRs. (9) Microprocessor/ Micro controller Based Projects. (10) Simulation Projects using Matlab. (11) Any other items as may be assigned by the teacher concerned.		

Part B: Entrepreneurship Development

Following activities related to Entrepreneurship Development is required to be dealt with, during this semester:

1. **Students should be taught about the basic idea of following aspects Entrepreneurship Development** :

Chapter	**Contents**
1.	**Entrepreneurship, Creativity & Opportunities** **03 Hrs** 1.1) Concept, Classification & Characteristics of Entrepreneur 1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers. 1.3) Intrapreneuring and Entrepreneurship.

	1.4) Business Idea: Methods and techniques to generate business idea. 1.5) Transforming Ideas in to opportunities : Transformation involves Assessment of idea & Feasibility of opportunity 1.6) SWOT Analysis
2.	**Information And Support Systems** **05 Hrs** 2.1) Industrial Policy reform in West Bengal 2.2) Financial assistance schemes of SIDBI (Small Industries Development Bank of India) 2.3) Financial assistance scheme of NSIC (National Small Industries Corporation) 2.4) Guidance/Assistance available from following organizations: i) National Research Development Corporation (NRDC) ii) Small Industries Service Institute(SISI) iii) State Financial Corporation (SFC) iv) District Industries Centre (DICs) v) Chambers of Commerce and Industry and Industrial Association
3.	**Forming of Business Organization** **02 Hrs** 3.1) Market Survey 3.2) Advantages and Disadvantages of following types organizations: a) Sole Proprietorship b) Partnership c) Joint stock company i) Private Limited Company ii) Public Limited Company 3.3) Assess yourself-are you an entrepreneur ?
4.	**Project Report Preparation** **06 Hrs** 4.1) Project Report and its utility 4.2) Preparation of Project Report of any one business. Following statements are required to be prepared: i) Calculation of working capital requirement. ii) Cost of Production. iii) Profitability Statement. iv) Cash Flow statement. v) Mean of Financing. vi) Land and site Development

vii) Building

viii) Plant and Machinery

ix) Preliminary and Pre-operative Expenses

x) Manpower Estimates Staff and Labour

xi) Administrative Overheads.

xii) Miscellaneous Assets.

xiii) Calculation of Depreciation.

xiv) Interest Calculation.

xvi) Project Implementation Schedule.

2. At the end of the semester every student has to prepare Project Report of a business model as mentioned above in chapter 4.

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
J.S. Saini B.S.Rathore	A Handbook of Entrepreneurship		Aapga Publication
Raj Shankar	Entrepreneurship Theory & Practice		TMH
Alpana Trehan	Entrepreneurship		Dreamtech Press
M.Schaper, T Volery, P Weber, K Lewis	Entrepreneurship And Small Business		Wiley
J.B.Patel D.G.Allampally	A Manual on How to Prepare a Project Report		EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
J.B.Patel S.S.Modi	A Manual on Business Opportunity Identification & Selection		
S.B.Sareen H. Anil Kumar	National Derectory of Entrepreneur Motivator & Resource Persons.		
Gautam Jain Debmuni Gupta	New Initiatives in Entrepreneurship Education & Training		
P.C.Jain	A Handbook of New Enterpreneurs		

Video cassette		
Sl no.	Subject	Source
1.	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
2.	Assessing Entrepreneurial Competencies	
3.	Business Opportunity Selection and Guidance	
4.	Planning for completion & Growth	
5.	Problem solving-An Entrepreneur skill	

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester.
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Action plan of Project and Project Report of Entrepreneurship Development – 35, Viva-voce – 15.**

Name of the Course: Utilization, Traction, Heating and Drives	
Course Code: EE/S5/UTHD	**Semester: Fourth**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks
Tutorial: hrs./week	Assignment & Quiz: 10 Marks
Practical: 2 hrs./week	End Semester Exam.: 70 Marks
	Practical : 50 Marks
Credit: 5 (Five)	

Aim:

Sl. No.	
1.	To understand basic areas of utilization of electrical energy e.g. illumination, motor drives etc.
2.	To study various methods of electric heating
3.	To understand basics of electric traction.
4.	To understand cost of electrical energy and conservation of electrical energy.

Objective:

Sl. No.	The students will be able to:
1.	Explain working of various sources of light and flood lighting
2.	Compare different methods of electric heating
3.	Select electric drives for specific applications.
4.	Explain concept of electric traction system.
5.	Apply various measures for economic aspects of utilizing electrical energy.

Pre-Requisite:

Sl. No.	
1.	Electrical Technology and Electrical Machines.

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	**Illumination**: 1.1. Definitions of Terms Used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilization Factor, Maintenance Factor, Depreciation Factor, Colour Renderng Index, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle, Beam Angle 1.2. Laws of Illumination: - Law of Inverse Squares - Lambert's Cosine Law. (No Numerical) 1.3 Types, basic principle, Details Specifications and application of following sources of light: - Incandescent Lamps.	10	18

	- Halogen Lamps. - Low Pressure Mercury Vapour Lamps (Fluorescent Tube). - High Pressure Mercury Vapour Lamps. - Sodium Vapour Lamps. - Compact Fluorescent Lamps (C.F.L.) - Metal Halide Lamps - LED Lamps - Neon Signs.		
Unit 2	**<u>Electric Heating and Welding</u>**: **Electric Heating** 2.1. Advantages of Electric Heating. 2.2. Classification of Electric Heating Methods: 2.2.1. Resistance Heating:(Construction, Operation and application) - Direct Resistance Heating: Salt Bath Furnace. - Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Name of some common heating element materials, Causes of Failure of Heating Elements, Methods of Temperature Control. 2.2.2. Arc Heating: (Construction, Operation and application) - Direct Arc Furnace: - Indirect Arc Furnace. 2.2.3. Induction Heating: (Construction & Operation and application) - Core Type Induction Furnaces: Ajax Wyatt Furnace. - Coreless Induction Furnace. 2.2.4. Dielectric Heating: - Principle of Dielectric Heating. - Advantages of Dielectric Heating - Limitations of Dielectric Heating. - Applications of Dielectric Heating. Power supply requirement and simple numerical of above heating methods. (No deduction of any formula) **Electric Welding:** 2.3. Methods of Electric Welding 2.3.1. Resistance Welding: - Principle of Resistance Welding. - Advantages of Resistance Welding. - Types of Resistance Welding - (Only List) Spot Welding Machine. 2.3.2. Electric Arc Welding: - Formation and Characteristics of Electric Arc. - Effect of Arc Length. - Arc Blow. Electrodes for Metal Arc Welding, V-I Characteristics required for of Arc Welding. 2.3.3. Arc Welding Machines: - DC Welding Machines - MG Set, AC Rectified Welding Unit. - AC Welding Machines - Welding Transformer.	14	20
Unit 3	**Electric Drives:** 3.1 – Introduction. - Drives - Mechanical Drive and Electric Drive. - Advantages and Disadvantages of Electric Drive. - Factors Governing Selection of Electric Motors. -Comparative discussion between the various Electric drive duties - continuous,	8	10

	short-time & intermittent. 3.2. Requirements of various types of common loads such as - Hoist, Elevator, Conveyor, Rolling mills, Centrifugal pumps, Punches, Shears etc. - Selection of motors in respect of types, size and rating for above loads on the basis of mechanical characteristics, speed control, reversibility, working environment and cost.		
Unit 4	**Electric Traction:** 4.1. Introduction: - History of electric traction - Various systems of traction. - Electric traction Vs other traction systems - Electric Traction as viable transport strategy for 21st Century -Choice of traction system: Diesel-electric or Electric. 4.2 Electric Traction: -Different systems of track electrification (Block diagram) DC, AC, Composite. Advantage & disadvantages of each. -analysis of single phase 25 KV AC system and DC system. 4.3. Traction Mechanics: - Units Used in Traction Mechanics. - Types of Services. - Speed Time Curve. - Simplified Speed Time Curve (No Derivation) - Average Speed and Schedule Speed. - Factors Affecting The Schedule Speed. - Tractive Effort - Specific Energy Consumption - Factors Affecting Specific Energy Consumption. - (Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption) 4.4. Mechanics of train movement, Adhesion & coefficient of Adhesion, concept of weight transfer, effect of unsprung mass and wheel diameter. 4.5. Traction Motors: - Desirable Characteristics of Traction Motors, Special features of traction motor. - Suitability of DC Series Motor for Traction. - Suitability of Three Phase Induction Motor for Traction.	10	15
Unit 5	**Economic Aspects of Utilising Electrical Energy:** 5.1 - Economic Aspects of Utilising Electrical Energy. 5.2 - Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges and running Charges. 5.3 - Formulation of Electrical Tariffs. 5.4 - Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consum 5.5 - Energy Conservation: Importance and need of Energy Conservation, Measures for Energy Conservation in (i) Electric Drives (ii) Electric Traction (iii) Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination.	6	7
	Total	48	70

Contents (Practical)	
Skills to be developed	
Intellectual Skills: i) Interpret results **ii) Calculate values of various components for given circuits.** **ii) Select Instruments**	
Motor Skills: i) Connect the instruments properly. **ii) Take accurate readings.** **iii) Draw related graphs.**	
List of Laboratory Experiments:	
Sl. No.	List of Practical: **(At least Eight Experiments are to be performed)**
1.	To determine Illumination of a surface for a Drawing Room by means of lux meter.
2	To determine candle power of a lamp in comparison to standard C.P. of lamp by optical bench method.
3	To verify the Inverse Square Law and compare the difference in output luminescence of incandescent, fluorescent and compact fluorescent lamps.
4	To Study of Sodium vapour lamp, Mercury vapour lamp, CFL with their connections and the technical specification.
5	To study of torques/Armature current, Speed/Armature current & Torque/Speed characteristics for D.C. series motor using mechanical loading. (Either braking arrangement or using D.C. Gen).
6	To study of different current collectors used for drawing current from O.H. system for traction (using models and block diagram).
7	To calculate the Total Cost in a (i) Residential and (ii) Commercial or Industrial Bill.
8.	To study of Electric Arc Welding using welding transformer.
9.	To study of the principle of Induction Heating using an induction heater.
10.	To Study Electricity Act 2003 : Energy Audit, role of energy manager, energy auditor and prepare power point presentation/report.

Text Books:

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
2	C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy	New Age
3	J. Upadhyay S. N. Mahendra	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd.
4.	A.T.Starr	Generation, transmission and utilization of Electrical power	
5.	J.B.Gupta	Utilization of Electric Power & Electric Traction	S.K.Kataria & Sons

EX A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1,	5	TWENTY	ONE	1 X 20 = 20	TWO	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	TEN	10 X 5 = 50
B	2	5				THREE			
C	3,5	5				THREE			
D	4	5				TWO			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job - 15, Notebook - 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job - 15, Viva-voce - 10.**

\

Name of the course : Illumination Engineering (Elective)	
Course Code : EE/S5/ILE (EL)	**Semester : Fifth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit:	

Aim:

Sl. No.	
1.	To measure the level of illumination.
2.	To study various types of lamps.
3.	To design illumination schemes for various applications in residential, commercial & industrial locations.

Objective:

Sl. No.	Student will be able to:
1.	Measure the level of illumination.
2.	Differentiate between various types of lamps.
3.	Identify & list of various lighting accessories and components.
4.	Design a control circuit for illumination.
5.	Design and execute illumination schemes for various applications in Residential, Commercial & Industrial locations.

Pre-Requisite:			
1.	Knowledge of Optics and light sources.		
2.	Wiring, switching and control circuits.		
Contents (Theory):		Hrs./Unit	Marks
Unit : 1	**1. Fundamentals of Light :** 1.1 Electromagnetic radiation & Light. 1.2 Electromagnetic spectrum – Ultraviolet, Visible, Infrared spectrum. 1.3 Human eye as an optical system – basic concept. 1.4 Spectral sensitivity of human eye – Photopic, Scotopic, Mesopic vision. 1.5 Visual characteristics – Brightness, Contrast, Glare, Flicker. 1.6 Visual performance - Visibility level, Contrast rendering factor. 1.7 Colorimetry – Visual basis, Source colour, Object colour. 1.8 Colorimetric instrument – Colorimetry of light source and materials, Colour rendering index.	**07**	**10**
Unit : 2	**2. Measurements:** 2.1 Photometry – Basic concept, Fundamentals of detector. 2.2 Photometric measurements – Methods to measure Luminous intensity, Luminous flux, Luminance, Illuminance. 2.3 Application of Polar Photometer & Goniophotometer. 2.4 Luxmeter – Working principle & Application. 2.5 CIE standard source of illuminant. 2.6 Radiation of energy – Black body radiation, Full radiator, Thermal radiation, Radiation from incandescent lamps.	**07**	**12**
Unit : 3	**3. Lamps & Accessories :** 3.1 Lamp materials – glass, filament, phosphor coating, ceramics, electrodes, gases, capping cement etc. 3.2 Theory & basic properties of low & high pressure gas discharge.	**10**	**12**

	3.3 Theory of operation, Life, Characteristics and Application of - a) High & Low pressure sodium vapour. b) High & Low pressure mercury vapour. c) Metal halide. d) Fluorescent lamp. e) LED. f) LASER. 3.4 Optical fiber – its construction as light guide, characteristics, application in lighting. 3.5 Luminaire – Types of luminaire, Design consideration, Indian standard recommendation.		
Unit : 4	**4. Illumination Control & Control circuits :** 4.1 Purpose of lighting control – Energy conservation. 4.2 Electromagnetic & Electronic ballast – Operation & comparison in light control. 4.3 Ignitor – its function in lamps. 4.4 Control circuits & operation of – a) Fluorescent lamp circuit. b) Low pressure sodium vapour lamp circuit. c) High pressure sodium vapour lamp circuit.	**08**	**12**
Unit : 5	**5. Interior Lighting :** 5.1 National standards of interior lighting calculation. 5.2 Lighting calculations of interior lighting. (Numerical) 5.3 Design considerations for interior lighting of - (a) Residential complex. (b) Commercial complex. (c) Industrial premises. 5.4 Design with Lighting design software. 5.5 Daylighting – Sky luminance pattern, Daylight factor, estimation of average daylight factor, window design considerations for maximum daylighting, Application of daylight in	**10**	**12**

	interior lighting. 5.6 Use of photocell, occupancy sensor in lighting controls. 5.7 Concept of Isolux contour in lighting design.		
Unit : 6	**6. Exterior Lighting :** 6.1 Lighting calculations of exterior lighting. (Numerical) 6.2 Calculation of lighting & design considerations for exterior lighting of - (a) Road lighting. (b) Flood lighting – Industrial complex, Commercial complex, Sports complex. 6.3 National & CIE standards of exterior lighting calculation.	**06**	**12**
	Total	**48**	**70**

Practical:
Skills to be developed:
Intellectual Skills:
1. To select appropriate equipment.
2. Apply different lighting designing skills.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to measure illuminance properly.
List of practical: (At least Eight Experiments are to be performed)
1. To measure illuminance (daylight & artificial light) at different points of a classroom by Luxmeter & draw – (i) Variation of Illuminance characteristics with distance and (ii) Isolux plot.
2. To study the technical data of different types of lamps available in the market & draw their connection diagram.
3. To study the different lighting accessories, ignitor & electronic ballasts required for different types of lamps – Sodium vapour, Mercury vapour, Metal halide, CFL, Fluorescent lamp.
4. To study the different luminaries available in the market for various types of lamps with their technical specifications, their design consideration, Indian standard recommendation.

5. To study of – (i) Photocell, (ii) Occupancy sensor in artificial lighting control.
6. To design an illumination scheme of a conference hall of medium size.
7. To design an illumination scheme for a workshop in your institute.
8. To design an illumination scheme for a playground of medium size.
9. To design an illumination scheme for a shopping complex of medium size.
10. To visit a standard lamp manufacturing industry and make a report on lamp manufacturing process.
11. A case study of optimum lighting design with lighting design software.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	Jack L. Lindsey	Applied Illumination Engineering	The Fairmont Press Inc.
2.	R.H. Simons, Robert Bean	Light Engineering : Applied calculations	Architectural Press
3.	Casimer M Decusatis	Handbook of Applied Photometry	Springer

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject: Energy Conservation and Audit (Elective)			
Subject Code: EE/S5/ECA(EL)		**Semester: Fifth**	
Duration: one Semester		**Maximum Marks: 150**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/ week		Mid Semester Exam.:	20 Marks
Tutorial:		Assignment & Quiz:	10 Marks
Practical: 2 hrs/week		End Semester Exam.:	70 Marks
Credit: 04		Practical :	50 Marks

Aim:

Sl. No.	
1.	To study causes for limited growth of conventional energy sources and limitations of non conventional sources of energy
2.	To study methods of energy conservation for different load conditions
3.	To Select appropriate tariff system and methods for reducing electricity consumption and energy saving.

Objective:

Sl. No.	The students will be able to:
1.	List causes for limited growth of conventional energy sources and limitations of non conventional sources of energy.
2.	Suggest methods of energy conservation for different load conditions.
3.	Select appropriate tariff system and methods for reducing electricity consumption and energy saving.
4.	Apply Tools for energy audit and recommend measures for energy conservation.

Pre-Requisite:

Sl. No.	
1.	Utilization of Electrical Energy
2.	Knowledge of energy sources

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Energy** Review of various energy sources, Need of energy conservation and energy audit.	04	08
Unit: 2	**Energy Conservation:** Lighting energy: methods/Techniques of efficient lighting . Heating: methods/Techniques of energy Saving in Furnaces, Ovens and Boilers. Cooling: methods/Techniques of Energy Saving in Ventilating systems and Air Conditioners Motive power, Energy Efficient Motors, and Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters . Power factor improvement devices and soft starters/Variable Frequency Drives. Amorphous Core Transformers Cogeneration -Types and Advantages.	12	18

Unit : 3	**Tariff and Energy Conservation in Industries:** Energy cost and Recent WBSEB tariffs, Application of Tariff System to reduce Energy bill, Energy conservation by improving load factor and power factor.	06	08
Unit : 4	**Energy Conservation In Transmission and Distribution Systems:** Reactive power compensation, demand side management, system voltage optimization and phase current balancing, Losses in transmission and distribution system and its minimization	08	08
Unit : 5	**Energy and the Environment:** Environment and social concerns related to energy utilization, The green house effect, Global Warming and its effect , Pollution, Acid Rains, Global Energy and environment Management.	04	08
Unit : 6	**Energy Audit:** Procedure of Energy audit, ABC analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. IE rules and regulations for energy audit, Electricity act 2003 (Numerical).	14	20
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Identify different methods used for energy conservation. 2. Understand the importance of energy conservation. 3. Select proper tariff for given industry/institute. 4. Collect technical information regarding electricity act.
2.	Motor Skills: 1. Prepare energy audit report. 2. Write visit report. 3. Use different methods of energy conservation. 4. Use of energy saving devices.

Suggested list of Experiments/Reports:

Sl. No.	Laboratory Experiments
1.	To save energy by using electronic ballast as compared to conventional choke.
2.	To Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.
3.	To make a survey of one establishment to identify different methods used for energy

	conservation.
4.	To prepare Energy audit report for Industry/workshop/ Institute .
5.	To search on the website of power ministry and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.
6.	To list energy saving equipments for domestic and commercial applications
7.	To list the different equipments used in energy auditing

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Siemens	Power Factor Correction		New Age Vol.38 2005
T.Gonen	Electric Power Distribution System Engg.		Tata McGraw Hill
M.J. Steinburg and T.H. Smith	Economy Loading of Power plant and Electric system		John Willey and sons
C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy		New Age 2004
Steven R. Patrick, Dale R. Patric Stephen W. Fardo	Energy conservation Guide book		Fairmont Press
Giovanni Petrecca	Industrial Energy Management: Principles and applications		Kluwer Academic Publisher

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5,6,	11				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Experiment/Reports – 15, Viva-voce – 10.**

Name of the Subject: HEATING, VENTILATION & AIR CONDITIONING (Elective)	
Subject Code: EE/S5/HVAC (EL)	**Semester : FIFTH**
Duration : One Semester	**Maximum Marks : 150**
Teaching Scheme	**Examination Scheme**
Theory : 03 hrs/week	Mid Semester Exam: 20 Marks
Tutorial: -- hrs/week	Assignment & Quiz: 10 Marks
Practical : 02 hrs/week	End Semester Exam: 70 Marks
Credit: 04	Practical : 50 Marks

Aim :-

S.No	
1.	This is a technology subject which is an elective subject for third year diploma in Electrical Engineering. Presently the need of Heating Ventilation and Air conditioning (HVAC) is increasing with the growth in IT sector, commercial establishments, hospitals, hotels etc. Therefore there is a growing need of engineers / technicians in this field. Hence, technicians/supervisors from electrical engineering branch are also expected to have some basic knowledge of HVAC systems.
2.	This subject covers installation, testing and maintenance of Heating Ventilation and Air conditioning systems. After completing this subject the student can carry out installation, testing and maintenance of HVAC equipment efficiently and effectively. He can work as service engineer or get self employed.
3.	Student can work with building management system (BMS).

Objective :-

S.No	The student will be able to:-
1.	Install HVAC equipment.
2.	Test the equipment for its performance evaluation.
3.	Carryout routine and preventive maintenance of HVAC system.
4.	Troubleshoot and repair HVAC equipment.
5.	Calculate heat load and approximate capacity of the equipment using thumb rule.
6.	Select appropriate equipment.

Pre-Requisite:-

S.No	
1.	Basics of electronic instrumentation

Content (Theory)		Hrs/Unit	Marks
Unit : 1	**Introduction** 1.1 Laws of thermodynamics 1.2 Comparison between heat engine, heat pump and refrigeration 1.3 Definitions of refrigeration, ton of refrigeration, COP, enthalpy, entropy	**02**	**04**

Unit : 2	**Types of refrigeration systems** 2.1 Vapour compression system – components used in vapour compression system, operation of vapour compression system, its representation on P – H and T – S diagrams, effect of superheating and under cooling of refrigerant. 2.2 Vapour absorption system – components used in vapour absorption system, its operation, its merits and demerits compared to vapour compression system 2.3 Air refrigeration system – components used in air refrigeration system, its operation and applications	**04**	**04**
Unit : 3	**Refrigerants and Lubrication** 3.1 Classification of refrigerants 3.2 Types of refrigerants presently in use 3.3 Desirable properties of refrigerants (Physical, chemical, thermodynamic) 3.4 Applications of important refrigerants 3.5 Eco-friendly refrigerants 3.6 Properties of lubricants 3.7 Lubricants and refrigerant compatibility 3.8 Foaming of oil and crankcase electric heater 3.9 Effect of lubricant flood back to compressor 3.10 Additives used in lubricants 3.11Necessity of oil separator	**06**	**06**
Unit : 4	**Components of vapour compression system** 4.1 Various types of compressors – reciprocating (hermetic, semi sealed, open), rotary (centrifugal, lobe type, screw type, blade type), applications of each type 4.2 Various types of condensers (air cooled, water cooled, evaporative), applications 4.3 Types of cooling towers – natural draft, forced draft 4.4 Types of evaporators – direct expansion type, flooded type, shell and coil type, double tube type, plate surface type 4.5 Throttling devices – hand expansion valve, constant pressure expansion valve, thermostatic expansion valve, high side float valve, capillary tube, electronic expansion valve 4.6 Accessories – receiver, oil separator, drier, strainer, solenoid valve **Note –** schematic diagram and brief description only of the above components 4.7 Applications of refrigeration – Ice plant, water cooler, refrigerator, milk dairy, cold storage, breweries, superconductors, transport refrigeration and air conditioning	**12**	**16**
Unit : 5	**Airconditioning** 5.1 Psychrometry – Definition, psychrometric properties of air, use of psychrometric chart 5.2 Representation of simple air conditioning process on psychrometric chart. 5.3 Sling psychrometer	**05**	**10**

	5.4 Air conditioning systems (Schematic layout, working and application of each of the following) • Central air conditioning system – direct expansion type, chilled water type • Package type air conditioning system • Unitary air conditioning system, split type system • Evaporative cooling 5.5 Applications of airconditioning – comfort airconditioning, industrial Air conditioning, transport air conditioning		
Unit : 6	**Components in air supply and distribution system** 6.1 Fans and blowers (centrifugal, axial flow) – schematic diagram and applications 6.2 Filters – (Dry, viscous, wet, electronic type) – schematic diagram and applications 6.3 Different types of humidifiers and dehumidifiers 6.4 Grills and registers 6.5 Duct system – heat gain or loss in ducts 6.6 Causes of pressure loss through air ducts 6.7 Different methods of duct designing	**04**	**06**
Unit : 7	**Thermal insulation** 7.1 Desirable properties of insulating materials for airconditioning purpose 7.2 Different types of insulating materials used for airconditioning 7.3 Selection of insulating materials for walls, ceiling, floor, air ducts, chilled water pipes	**02**	**04**
Unit : 8	**Controls used in airconditioning** 8.1 High pressure and low pressure cutouts, overload protector, thermostat, oil safety switch, fusible plug, pressure equalizer 8.2 Microprocessor based controls and variable frequency drive 8.3 Fluid flow control devices (simple sketch and wiring diagram is expected)	**03**	**06**
Unit : 9	**Heat load** 9.1 Definitions – SHF, RSHF, EFSHF 9.2 Factors responsible for heat load 9.3 Conditions of airconditioning and representation of comfort zone on psychrometric chart 9.4 Determination of capacity of airconditioning unit by referring tables only (no calculations)	**03**	**06**
Unit : 10	**Heating and ventilation** 10.1 Plain heating, electric heating, steam heating, hot water heating, solar heating 10.2 Heating with humidification and heating with dehumidification 10.3 Natural ventilation 10.4 Mechanical ventilation – 1) Air extraction system 2) Air supply system, combined supply and extraction system 10.5 Air distribution system – perimeter system, extended plenum system, upward flow system, downward flow system, ejector system 1o.6 Return duct system (only schematic diagrams and brief description of the above system)	**07**	**08**
	Total	**48**	**70**

Contents (Practical)	
Sl. No.	Skills to be developed
1.	Intellectual Skills: 1. Interpret results 2. Write specifications
2.	Motor Skills: . 1. Conduct trial 2. Read drawing and identify components 3. Carry out Welding
Sl. No.	**list of Experiments/Reports (Any eight)**
1.	To carryout trial on vapour compression test rig for finding its performance.
2.	To dismantle and assemble open type and hermetic type compressors, to draw freehand sketches of various parts and to write specifications of compressors.
3.	To carryout copper tube welding
4.	To study and draw block diagram of control panel wiring with respect to L.P. / H.P. cutouts, oil pressure cutout, thermostat, humidistat, solenoid valve
5.	To troubleshoot the air-conditioning plant in relation to a) High condenser pressure b) Low cooling effect c) Reduced volume of supply of air d) compressor not starting
6.	To prepare maintenance schedule of central air conditioning plant – weekly, quarterly, half yearly, yearly
7.	To demonstrate and study of various tools used in refrigeration such as – tube cutter, bending tools, flaring tool (block and yoke type), swaging tool, brazing tool, blow lamp etc.
8.	To demonstrate purging, gas charging, leak testing and pump down of the refrigeration system
9.	To visit to air conditioned hotel or theater to study control panel and various controls, starting and stopping system, air supply and air return system. Write a detailed report.
10.	To visit to cold storage to study different components of vapour compression system, temperature and humidity conditions required for different food items. Write a detailed report.
11.	To prepare a report (use internet) based on the following points to purchase an air conditioner: i)Manufactures, ii)Technical specifications, iii) Features offered by different manufacturers, iv) Price range. Then select the air conditioner which you would like to purchase. Give justification for your selection in short.
	Note: For visits professional practices periods may be utilized.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
P. N. Anathanarayanan	Basic Refrigeration and Air-conditioning		Tata Mcgraw Hill, New Delhi
M. Adithan, S.C. Laroyia,	Practical Refrigeration and Air-conditioning		New Age International (P) Ltd.

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	5,6,7,8,9 ,10	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job – 15, Notebook – 10.**
2. **External Assessment of 50 marks** shall be held at the end of the Fifth Semester. **Distribution of marks: On the basis of Experiment/Reports – 15, Viva-voce – 10.**

Name of the Subject : Electric Traction (Elective)			
Subject Code: EE/S5/ET(EL)		**Semester: Fifth**	
Duration: one Semester		**Maximum Marks: 150**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester Exam.: 20 Marks	
Tutorial: hrs./week		Assignment & Quiz: 10 Marks	
Practical: 2 hrs./week		End Semester Exam.: 70 Marks	
		Practical : 50 Marks	
Credit: 04			

Aim:

Sl. No.	
1.	One of the practical applications of electricity, which enters into the everyday life of many of us, is its use in service of mass transport – the electric propulsions of vehicles – electric trains, trolley buses, tram cars and in the latest developments such as metro and sky bus.
2.	In view of the growing importance and technological developments, which have come about in this area in the recent past; for Electrical Engineering students, it is desirable to study the course dealing with electric traction.

Objective:

Sl. No.	The students will be able to:
1.	Identify and explain use of components of the power supply arrangements for electric traction.
2.	Maintain different overhead equipments.
3.	Differentiate the various types of current collecting systems and current collecting gears based on utility.
4.	Differentiate the various types of current collecting systems.
5.	Explain special requirements of train lighting and various systems of train lighting.
6.	Describe the recent trends in Electric traction, such as LEM propelled traction

Pre-Requisite:

Sl. No.	
1.	Utilization, traction & Heating in 4th Semester.
2.	A.C and D.C. Motors and Power Supply

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	1.1 - Nomenclature used For Electric Locomotives 1.2 - Types of Electric Locomotives by Nomenclature. 1.3 – AC Locomotive: 1.3.1 - Equipments of AC Electric Locomotive: - Power Circuit Equipments and Auxiliary Circuit Equipments. 1.3.2- Equipments in Power Circuit and their Functions: - Power Circuit Diagram of AC Locomotive: Pantograph, Circuit breaker, Tap Changer, Traction Transformer, Rectifier, Smoothing, Choke, Traction Motor. 1.3.3 - Equipments in Auxiliary Circuit & their Functions: Head Light, Flasher Light, Horn, Marker Light, Batteries, Arno Converter, Blowers, Exhausters, Compressors, Selsyn transformer.	12	18
Unit 2	2.1 – Constituents of Supply System: Substations, Feeding Posts, Feeding and Sectioning Arrangements, Sectioning and Paralleling Post, Sub sectioning and Paralleling Post, Sub sectioning Post, Elementary Section, Miscellaneous Equipments at Control Post or Switching Stations.	08	10

	2.2 – List of Major Equipments at Substation. 2.3 – Location and spacing of substation.		
Unit 3	**Overhead Equipments:** 3.1 – Overhead Equipments (OHE). 3.2 – Principles of Design of OHE: Composition of OHE, Height of Contact Wire, Contact Wire Gradient, Encumbrances, Span Length. 3.3 – Automatic Weight Tension and Temp. Compensation. 3.4 – Uninsulated Overlaps. 3.5 – Insulated Overlaps. 3.6 – Neutral Section. 3,7 – Section Insulator. 3.8 – Isolator. 3.9 – Polygonal OHE: Single Catenary Construction, Compound Catenary Construction, Stitched Catenary Construction, Modified Y Compound Catenary. 3.10 – Effect of Speed on OHE. (No derivation and No numerals)	09	12
Unit 4	**Current Collecting Equipments:** 4.1 – Introduction. 4.2 – Systems of Supplying Power in Electric Traction: Overhead System, Third Rail or Conductor Rail System. 4.3 – Current Collectors for Overhead System: - Trolley Collector or Pole Collector, Bow Collector, Pentograph Collector. 3.4 – Types of Pentographs: Diamond Pentograph and Faiveley Type. 3.5 – Methods of raising and lowering of Pentograph	06	10
Unit 5	**Train Lighting:** 5.1 – Systems of Train Lighting. 5.2 – Special Requirements of Train Lighting. 5.3 – Method of obtaining Unidirectional Polarity. 5.4 – Method of obtaining Constant Output. 5.5 – Single Battery System. 5.6 – Double Battery Parallel Block System.	05	8
Unit 6	**LEM Propelled Traction:** 6.1 – Introduction. 6.2 – Linear Electric Motor (LEM) 6.3 – Linear Induction Based Traction System: - Moving Primary Fixed Secondary Single Sided LIM. - Moving Secondary Fixed Primary Single Sided LIM. - Moving Primary Fixed Secondary Double Sided LIM. 6.4 – Strengths/Weaknesses of LIM Propelled Railway Traction: - Strengths of LIM Propelled Railway Traction System. - Weaknesses of LIM Propelled Railway Traction System. 6.5 – LIM Propelled Underground Metro Rail System: - Factors Influencing Adoption of LIM for Metro Rail. - International Scenario. 6.6 – Wheel Less Traction: Levitation Schemes, Present Scenario.	08	12
	Total	48	70

Contents (Practical)

List of Practical Work:

Sl. No.	Nature of work (students are expected to identify and explain function of each item related to their work)
1.	To study of Electric AC Locomotives.
2	To study of Different types of Relays, Contactors used in AC Locomotive
3	To prepare drawing (on half Imperial sheet) for Power Circuit of any type of Electric Locomotive
4	To prepare drawing (on half Imperial sheet) for Protection of Electric Locomotive.
5	To prepare drawing on half Imperial sheet for Traction Substation Layout or Feeding Post
6	To prepare drawing on half Imperial sheet for Pentagonal OHE Catenary, Different Catenary according to speed limit, Cantilever assembly, OHE Supporting structure, Pantograph, Cross section of Contact Wire.
7	To visit to Traction Substation (for substation layout and OHE) and writing a report. Also write a report on OHE maintenance schedule.
8	To visit to Railway Station (for signaling and train lighting) and writing a report
9	**Mini Project:** Collection of information using Internet on any two topics related to electric traction and submission of printouts

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
2	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publishers Ltd.
3	Andreas Steimel	Electric Traction –Motive Power and Energy supply	Oldenbourg-indstrieverlag

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1,	5	TWENTY	ONE	1 X 20 = 20	TWO	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	TEN	10 X 5 = 50
B	2,3	7				FOUR			
C	4,5	5				TWO			
D	6	3				TWO			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

EXAMINATION SCHEME (SESSIONAL)

2. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Fifth Semester. **Distribution of marks: Performance of Job - 15, Notebook - 10.**
3. **External Assessment of 25 marks** shall be held at the end of the Fifth Semester on the Practical work done throughout the semester. **Distribution of marks: Mini Project work - 5, Sessional work – 5, Viva-voce - 15.**

Name of the Subject: Professional Practices III	
Subject Code: EE/S5/PFIII	**Semester: Fifth**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 3 hrs / week	End Semester Exam.: Marks
	Practical : 50 Marks
Credit: 2	

Aim:

Sl. No.	
1.	To acquire information from different sources
2.	To present a given topic in a seminar, discuss in a group discussion
3	To prepare report on industrial visit, expert lecture.

Objective:

Sl. No.	The student will be able to
1.	Acquire information from different sources
2.	Prepare notes for given topic
3.	Present given topic in a seminar
4	Interact with peers to share thoughts
5	Prepare a report on industrial visit, expert lecture

Pre-Requisite:

Sl. No.	
1.	Survey of different electrical industries

Activities

Sr . No.	Activities	Hours
1.	**Industrial / Field Visit :** Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to **<u>any one</u>** from the list below (should not have completed in earlier semester): i) A thermal power generating station ii) A Hydel power generating station iii) A Wind mill and / or Hybrid power station of wind and solar iv) An electrical substation v) A switchgear manufacturing / repair industry vi) An Electrical machine manufacturing industry vii) A large industry to study protection system viii) Any Industry having Automation for manufacturing processes	**12**

	ix) A transformer repair Workshop x) Industry of power electronics devices xi) Maintenance department of a large industry. xii) A Loco shed xiii) Railway / metro railway signaling system xiv) Transmission tower project area xv) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xvi) Any other technical field area as may be found suitable alternative to above list.	
2.	**Guest Lecture by professional / industrial expert**: Lectures by Professional / Industrial Expert to be organized from **<u>any TWO</u>** of the following areas (not covered in earlier semesters): i) Modern trends in AC machine ii) Automotive wiring and lighting iii) Modern techniques in Power Generation iv) New trends in power electronics devices v)TQM vi)Recent modification in IE rules vii)Role of power factor improvement as a tool in reducing cost of generation viii) Digital metering ix) Hydro power generation x) Functioning of Electricity regulatory Commission. xi)Introduction and application areas for MEMS (Micro Electromechanical System) xii) Interview techniques xiii)Career opportunities for diploma engineers xiv) Cyber crime & Cyber laws xv)Social networking – effects & utilities xvi) Ethical Hacking. xvii) Industrial Dispute and Labour Laws xviii)Entrepreneurship development and oppurtunities xix) Role of micro, small and mediun enterprise. In Indian economy. Individual report of the above lecture should be submitted by the students.	**4**
3.	**Seminar / Poster presentation:** Students should either present in seminar or prepare poster on **ANY ONE** topic as suggested below (should not be already done in earlier semester): Students (Group of 4 to 5 students) have to search / collect information about the topic through literature survey/ internet search / visit and discussion with expert or concerned persons	**12**

	1. Magnetic Levitation system 2. Recent development in electrically operated vehicles for mass development 3. Alternative fuel and energy options 4. Schemes of power generation in coming five years 5. Impact of load shedding on rural population 6. Embedded system 7. Computer security 8. Bio – technology 9. Scheme for setting up a new venture in MSME sector 10. Comparative study of Metro railway in Kolkata and Delhi 11. Brushless commutation of DC motors **12.** Any other topic of present techno economic relevance as may be decided by concerned teacher.	
4.	**Group Discussion** The students should discuss in a group of six to eight students. Each group to perform **<u>any TWO</u> group discussions**. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested topics are – i) Role of Electrical Engineer in Disaster management ii) CNG Vs LPG as fuel iii) Load shedding and remedial measures iv) Rain water harvesting v) Trends in energy conservation vi) Safety in day to day life vii) Energy saving in the institute vii) Pollution control viii) Any other common topic related to electrical field as directed by concerned teacher.	**12**
5.	**Students' Activities / mini project (any one):** i) Develop a website for your institute ii) Animation project using c, c++, VB ii) Prepare a report in open software Latex. Report should include text, table, figure, mathematical expression, heading etc. all features of a report. iii) Make a list of all items required to assemble an updated version of personal computer. Write technical specification, manufacturers' names, cost of all the parts and prepare a comparative analysis to arrive at a decision for final combination of items. Also make such list for required external hardware/devices. Prepare a powerpoint presentation alongwith the report. Students are encouraged to use open softwares for such purpose.	**8**

	iv) The students in a group of 3 to 4 will collect information from market regarding specification, cost, frame size of motors produced by different manufacturers as available in the market for household pump motors, industrial motors etc. They will submit individual report on the same.	

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous internal assessment of 50 marks** is to be carried out by the teachers throughout the Fifth semester. **Distribution of marks: Activities =20, Group Discussion = 10, field visit = 10, guest lecture attendance and report = 10**

W.B.S.C.T.E.

TEACHING AND EXAMINATION SCHEME FOR DIPLOMA COURSES

COURSE NAME: ELECTRICAL ENGINEERING

COURSE CODE : EE

DURATION OF COURSE : 6 SEMESTERS

SEMESTER: SIXTH SEMESTER **SCHEME : C**

Sr.No	SUBJECT	PERIODS			EVALUATION SCHEME							Credits
					SESSIONSAL EXAM				PR(INT.)	PR (EXT.)		
	THEORY	L	T	P	TA	CT	Total	ESE				
1	Electrical Design Estimation & Costing	04		03	10	20	30	70	25	25		5
2	Electrical Installation , Maintenance , Testing	04			10	20	30	70				4
3	Industrial Project			05					50	50		3
4.	Electrical Workshop II			03					25	25		1
4	Industrial Management	03			10	20	30	70				3
5	Elective II (Any One)	03	--	03	10	20	30	70	25	25		4
	Industrial Automation											
	Process Control											
	Control of Electrical Machine											
	Computer Hardware & Networking											
6	Professional Practice -IV			04					50			2
7	General Viva voce								100			2
	Total	**14**		**18**	**40**	**80**	**120**	**280**	**275**	**125**		**24**

STUDENT CONTACT HOURS PER WEEK: **32 HRS**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, T - Tutorial, PR (INT.) – Practical (Internal) PR(EXT.)- Practical(External), ESE - End Semester Exam.

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks : 800

Minimum passing for sessional marks is 40%, and for theory subject 40%.

Name of the Subject: Electrical Design, Estimation & Costing	
Subject Code: EE/S6/EDEC	**Semester: S6**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 4 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 3 Hrs/week	End Semester Exam.: 70 Marks
Credit: 5	Practical : 50 Marks

Aim:

Sl. No.	
1.	Electrical Diploma holders have to work as Technicians & Supervisors for Electrical Installations of various companies, commercial and Industrial electrification schemes and prepares estimates for these schemes.
2.	Knowledge of electrical engineering drawing, IE rules, NEC, different types of electrical Installation their design considerations equips the students with the capability to design and prepare working drawing of different Installation projects.
3.	Understanding of the methods and procedure of estimating the material is also required

Objective:

Sl. No.	Student will be able to:
1.	State IE rules, NEC related to Electrical Installation and testing
2.	Interpret the Electrical Engineering Drawing
3.	State and describe the basic terms, general rules, circuit design procedure, wiring design and design considerations of Residential Electrical Installations,
4.	Explain the sequence to be followed in carrying out the estimate of Residential Electrical Installations.
5.	Design of main dimensions of rotating machines.
6.	Design of core and winding of a 3-phase transformer up to 200KVA
7.	Understand the concept of contracts, contractors, tender and tender document and its related procedures.

Pre-Requisite:

Sl. No.	
1.	Basic Electrical Engineering
2.	Engineering Graphics

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Standard Norms and Specifications:** Importance of Design-Estimation-Costing of electrical equipments & installations, Concept of I.E. Rules, Importance of Standards & Specifications for electrical installation and equipments. **Indian Electricity Rules (1956):** Rule 28 : Voltage level definitions. Rule 30: Service lines & apparatus on consumer	04	06

	premises. Rule 31: Cut-out on consumer's premises. Rule46: Periodical inspection & testing of consumer's installation. Rule 47: Testing of consumer's installation. Rule 54: Declared voltage of supply to consumer. Rule 55: Declared frequency of supply to consumer. Rule 56: Sealing of meters & cut-outs. Rule 77: Clearances above ground of the lowest conductor. Rule 79: Clearances between conductors & trolley wires. Rule 87: Lines crossing or approaching each other. Rule 88: Guarding.		
Unit: 2	**Design of Lighting circuits:** Illumination level required for various applications, Factors considered for good lighting design, Determination of number of lamps & selection of lamp type, Design for placement of lamps in a room for proper & uniform illumination. (Numerical)	04	06
Unit: 3	**Service Connection** 3.1 Concept of service connection. 3.2 Types of service connection & their features. 3.3 Methods of Installation of service connection. 3.4 Estimation of under ground & overhead domestic service connections. (Numerical)	06	08
Unit: 4	**Residential Building Electrification** 4.1 General rules guidelines for wiring of Residential Installation and positioning of equipments. 4.2 Principles of circuit design in lighting and power circuits. 4.3 Procedures for designing the circuits and deciding the number of sub- circuits. 4.4 Method of drawing single line diagram & wiring diagram 4.5 Selection of type of wiring and rating of wires & cables. 4.6 Selection of rating of main switch, distributions board, protective switchgear ELCB, MCB and wiring accessories. 4.7 Earthing of Residential Installation. 4.8 Sequence to be followed for preparing Estimation of wiring. 4.9 Preparation of detailed estimates and costing as per PWD schedule of electrification of Residential Installation. (Numerical)	10	10
Unit: 5	**Electrification of commercial Installation** 5.1 Concept of commercial Installation. 5.2 Differentiate between electrification of Residential and commercial Installation (shopping	12	12

	mall, Office complex) 5.3 Fundamental considerations for planning of an electrical Installation system for shopping mall/office complex. 5.4 Design considerations of electrical Installation system for air conditioned shopping mall/office complex. 5.4.1 Load calculations & selection of accessories for connection. 5.4.2 Deciding the size of cables, busbar and busbar chambers. 5.4.3 Mounting arrangements and positioning of switchboards, distribution boards main switch etc. 5.4.4 Earthing of the electrical Installation 5.5 Selection of type wiring system & layout. 5.6 Sequence to be followed to estimate of wiring. **5.7** Preparation of detailed estimate and costing as per PWD schedule of electrification of shopping mall/office complex.		
Unit: 6	**Electrification of factory unit Installation** 6.1 Important guidelines about power wiring and Motor wiring. 6.2 Design consideration of Electrical Installation in small Industry/Factory/workshop. 6.2.1. Motor current calculations. 6.2.2. Selection and rating of wire, cable size. 6.2.3 Deciding fuse rating, starter, distribution boards main switch etc. 6.2.4. Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing. 6.3 Sequence to be followed to prepare estimate. **6.4** Preparations of detailed estimate and costing as per present market rate of small factory unit/workshop.	10	10
Unit: 7	**Design of Electrical Transformer:** **a) Single phase transformer up to 1 KVA-** Core Design, Selection of stamping, winding design, window area calculation. (Numerical) **b) 3-phase transformer up to 250 KVA -** Basic design principles and approaches, Specification, Magnetic circuit, Output equations and Output Co-efficient, Core construction and design, Window design, Winding design, Size of tank, Winding temperature rise, Insulation classes, Cooling methods. (Numericals)	10	10
Unit: 8	**Contracts, Tenders and Execution** 8.1 Concept of contracts and Tenders 8.1.1 Contracts, types of contracts, contractors. 8.1.2 Valid Contracts, Contract documents. 8.1.3 Tender and tender notices. 8.1.4 Procedure for submission and opening	08	08

	tenders. 8.1.5 Comparative statements, criteria for selecting contractors, General conditions in order form. 8.2 Principles of Execution of works 8.2.1 Administrative approval, Technical sanctions. 8.2.2. Billing of executed work.		
	Total	**64**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Analytical Skill ii) Identification skill
2.	Motor Skills: i) Operate various parts of computer properly. ii) Problem solving skill.

Suggested list of Laboratory Experiments:

Sl. No.	Laboratory Experiments
1.	A newly constructed workshop is required to be fitted with a 10 H.P. Squirel cage induction motor. I) Draw Installation plan showing location of main control board, motor control board, motor etc, (using CAD) ii) Draw single line wiring diagram. (using CAD) iii) Draw wiring diagram starting from energy meter upto electric motor. (using CAD)
2.	Draw Single line diagram and layout plan of 11KV indoor Substation (using CAD)
3.	Draw Sectional Drawing of different types of cables, overhead conductors (using CAD)
4.	Draw Sectional Drawing of different types of insulators (using CAD)
5.	Draw Core construction, H.T. & L.T. winding, other accessories of 3 phase transformer (using CAD).
6.	Draw pole, yoke , field coils, commutator and its details of D.C. Machine (using CAD).
7.	Draw transmission line structure (using CAD)

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
K.B. Raina S.K.Bhattacharya	Electrical Design; Estimating and costing		New Age International (p) Limited, New Delhi
Surjit Singh	Electrical Estimating and costing		Dhanpat Rai and company, New Delhi
J.B.Gupta	A course in Electrical Installation, Estimating & costing		S.K.Kataria & sons
S.L. Uappal	Electrical wiring Estimating and costing		Khanna Publication.
A.K.Sawhney	Electrical Machine Design		Danpat Rai & co.
	The Electricity Rule 2005		Universal Law Publishing Co. Pvt. Ltd.
N. Alagappan S. Ekambaram	Electrical Estimating and costing		Tata Mc Graw Hill Publication, New Delhi
Surjit Singh	Electrical Engineering Drawing		S.K.Kataria & Sons

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4,5	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	6,7,8	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Notebook(Drawing Sheet)– 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Drawing sheet from any one of the above is to be drawn. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject : Electrical Installation , Maintenance , Testing	
Subject Code: EE/S6/EIMT	**Semester: SIXTH**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory: 4 Hrs/week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 3 Hrs/Week	End Semester Exam.: 70 Marks
Credit:	Practical : NIL

Aim:

Sl. No.	
1.	This is technology level subject with application in Industry, commercial, public utility departments such as PWD, Electricity Board etc.
2.	After studying this subject student will be able to inspect, test, install & commission electrical machines as per IS .

Objective:

Sl. No.	The student will be able to:
1.	• Know safety measures & state safety precautions.
2.	• Test single phase, three phase transformer, DC & AC machine as per IS.
3.	• Identify / Locate common troubles in electrical machines & switch gear.
4.	• Plan & carry out routine & preventive maintenance.
5.	• Install LV switchgear & maintain it.
6.	• Ascertain the condition of insulation & varnishing if necessary.
7.	• Identify faults & measures to repair faults.

Pre-Requisite:

Sl. No.	
1.	Knowledge of electrical equipments

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	**Safety & Prevention of Accidents:** 1.1 Definition of terminology used in safety 1.2 I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation 1.3 Dos & don'ts for substation operators as listed in IS. 1.4 Meaning & causes of electrical accidents factors on which severity of shock depends, 1.5 Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, 1.6 Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers	05	05
Unit: 2	**General Introduction:** 2.1 Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests. 2.2 Methods of testing a) Direct, b) Indirect, c) Regenerative. 2.3 Classification and need of maintenance 2.4 Advantages of preventive maintenance, procedure for developing	05	05

	preventive maintenance schedule, 2.5 Factors affecting preventive maintenance schedule. 2.6 Introduction to total productive maintenance.		
Unit: 3	**Testing & maintenance of rotating machines:** 3.1 Type tests, routine tests & special tests of 1 & 3 phase Induction motors, 3.2 Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992 3.3 Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968 3.4 Brake test on DC Series motor.	10	10
Unit: 4	**Testing & maintenance of Transformers:** 4.1Listing type test, routine test & special test as per I.S. 2026-1981 4.2 Procedure for conducting following tests: Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, open delta (delta – delta) test. 4.3 Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028(part III): 1981	10	10
Unit: 5	**Testing & maintenance of Insulation:** 5.1 Classification of insulating materials as per I.S. 8504(part III) 1994. 5.2 Factors affecting life of insulating materials. 5.3 Methods of measuring temperature of internal parts of windings/ machines & applying the correction factor when the machine is hot. 5.4 Properties of good transformer oil. List the agents which contaminates the insulating oil. 5.5 Understand the procedure of following tests on oil as per I.S. 1692-1978 a) acidity test b) sludge test c) crackle test d) flash point test. 5.6Filtration of insulating oil 5.7 Protection of electrical insulation during the period of inactivity. 5.8 Methods of cleaning the insulation covered with loose, dry dust, sticky dirt, & oily viscous films, procedure for cleaning washing & drying of insulation & revarnishing. 5.9 Methods of internal heating & vacuum impregnation.	08	10
Unit: 6	**Trouble shooting of Electrical Machines & Switch gear:** 6.1Significance of trouble shooting of various electrical machines and describes the procedure for the same. 6.2 Various types of faults (mechanical, electrical & magnetic) in electrical machines and reason for their occurrence. 6.3 Use of following tools: Bearing puller, Filler gauge, dial indicator, spirit level, growler. 6.4 Trouble shooting charts for Single & 3-phase induction motor, Single & 3- phase transformer. 6.5 List the common troubles in HV and LV switchgear, contactors & batteries.	08	10
Unit: 7	**Installation:** 7.1 Inspection procedure of Machine Installation. 7.2 Factors involved in designing the machine foundation, 7.3 Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. 7.4 Installation of rotating machines as per I.S. 900-1992.	12	10

	7.5 Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment. 7.6 Method of drying out of Machines. 7.7 Classification of transmission tower 7.8 Installation of Transmission Tower (From foundation to complete erection).		
Unit: 8	**Earthing:** 6.1 Introduction & importance. 6.2 Step potential & Touch potential. 6.3 Factors affecting Earth Resistance. 6.4 Methods of earthing 6 .5 Substation and Transmission Tower earthing 6.6 Transformer Neutral Earthing.	06	10
	Total	**64**	**70**

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Tarlok Sibgh	Installation, Commissioning & Maintenance of Electrical Equipment		S.K.Kataria & Sons
B.V.S.Rao	Operatin & Maintenance of Electrical Machines Vol I & II		Media Promoters & Publisher Ltd. Mumbai

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4,5	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	6,7,8	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

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Name of the Course: Electrical Workshop II	
Course Code: EE/S6/WSII	**Semester: SIXTH**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	**Practical : 50 Marks**
Tutorial:	
Practical: 3 hrs./week	
Credit: 1 (One)	

Aim:	
Sl. No.	
1.	A technician should carry out routine & preventive maintenance of electrical machines & possesses knowledge of Indian Electricity Act, safety rules, safety of machines & persons, prevention of accident. He/She should also able to repair various appliences.

Objective:	
Sl. No.	
1.	• Identify / Locate common troubles in electrical machines & switch gear.
2.	• Plan & carry out routine & preventive maintenance.
3.	• Ascertain the condition of insulation & varnishing if necessary.
4.	• Identify faults & measures to repair faults.

Pre-Requisite:	
Sl. No.	
1.	Knowledge of electrical equipments and accessories.

Contents (Practical)

Suggested list of Practicals/Exercises:	
Sl. No.	Practicals/Exercises
1.	To Demonstrate various components of D.O.L., Star-Delta and Auto Transformer Starter.
2.	To prepare a report on specifications of earthing at different substations/different locations & new trends in earthing schemes.
3.	To observe & carry out periodic maintenance of D.C & A.C. motor in your workshop or laboratories & prepare its report
4.	To prepare trouble-shooting chart & carry out maintenance of a single and three phase transformers
5.	To prepare trouble-shooting chart & carry out maintenance of single and three phase induction motors
6.	To prepare trouble-shooting chart for HV and LV Switch Gear

7.	To carry out filtration of insulating oil and measure Break Down Voltage.
8.	**Dismantling, assembly, testing, preparation of list of components, parts for: (any four)** i) D.C. compound motor ii) 3 phase Induction motor. iii) Geyser. iv) UPS / Inverters / battery chargers v) Microwave Ovens vi) Semi automatic & fully automatic washing machine

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

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Name of the Subject : ELECTRICAL ENGINEERING PROJECTS	
Subject Code: EE/S6/EEP	**Semester: Sixth**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 5 hrs/week	End Semester Exam.: Marks
Credit: 03	Practical : 100 Marks

Aim:	
Sl. No.	
1.	This subject is intended to teach students to understand facts, concepts and techniques of electrical equipments, its repairs, fault finding and testing, estimation of cost and procurement of material, fabrication and manufacturing of various items used in electrical field
2.	This will help the students to acquire skills and attitudes so as to discharge the function of supervisor in industry and can start his own small-scale enterprise

Objective:	
Sl. No.	
1.	• Develop leadership qualities.
2.	• Analyze the different types of Case studies.
3.	• Develop Innovative ideas.
4.	• Develop basic technical Skills by hands on experience.
5.	• Write project report.
6.	• Develop skills to use latest technology in Electrical field.

Pre-Requisite:	
Sl. No.	
1.	Knowledge of subjects up to 5th Semester of Electrical Engineering
2.	

Contents

This subject is the continuation of the part of **Industrial Project** of subject "**INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT** " studied in 5th Semester. Following activities related to project are required to be dealt with, during this semester.

1 . Each project batch should carry out the actual Project works which have been approved in Fifth Semester.

2.At the end of this semester each project batch should prepare the detailed project report & submit the same to respective guide.

The list of projects are same as in 5th semester which are as follows:

Group	Projects
1	(1) Design of Rural Electrification Scheme for small Village, Colony. (2) Energy Conservation and Audit. (3) Substation Model (Scaled) (4) Wind Turbine Model (Scaled) (5) Pole Mounted Substation Model (Scaled) (6) Conduct load survey to ascertain the total load requirements of a locality / polytechnic. (7) Any other items as may be assigned by the teacher concerned.
2	(1) Rewinding of Three Phase/Single Phase Induction Motor. (2) Rewinding of Single Phase Transformer. (3) Fabrication of Inverter up to 1000 VA. (4) Fabrication of Battery Charger. (5) Fabrication of Small Wind Energy System for Battery Charging. (6) Fabrication of Solar Panel System for Battery Charging. (7)Fabrication of Water level controller. (8)Fabrication of DC motor speed control circuit by SCRs. (9) Microprocessor/ Micro controller Based Projects. (10) Simulation Projects using Matlab. (11) Any other items as may be assigned by the teacher concerned.

Continuous Internal Assessment of 50 marks is to be carried out by the teachers throughout the semesters.
Distribution of marks: Project Work – 25, Project Report Presentation – 15, Viva-voce – 10**.**

External assessment of 50 marks shall be held at the end of the Sixth Semester on the entire Project Work.
The external examiner is to be from Industry / Engineering College / University / Government Organisation.
Distribution of marks: Project Work - 25, Project Report Presentation – 15, Viva-voce – 10**.**

West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Subject : Industrial Management	
Subject Code: EE/S6/IM	**Semester: Sixth**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical:	End Semester Exam.: 70 Marks
Credit: 03	Practical : NIL Marks

Aim:

Sl. No.	
1.	To study the techniques for improvement in productivity of the people and equipment. to plan the production schedule accordingly organize material supply for the manufacturing activities. To minimize the direct and indirect cost by optimizing the use of resources available. To learn accounting process, inventory control and process planning. Modern manufacturing system employ techniques such as JIT, TPM , FMS, 5'S', kaizen which should be known to the technician.

Objective:

Sl. No.	The student will able to
1.	Familiarize environment in the world of work
2.	Explain the importance of management process in Business.
3.	Identify various components of management
4.	Describe Role & Responsibilities of a Technician in an Organizational Structure.
5.	Apply various rules and regulations concerned with Business & Social Responsibilities of the Technician

Pre-Requisite: NIL

	Contents (Theory)	Hrs./Unit	Marks
GROUP A			
01	**Overview Of Business** 1.1. Types of Business □ Service □ Manufacturing □ Trade 1.2. Industrial sectors Introduction to □ Engineering industry □ Process industry □ Textile industry □ Chemical industry □ Agro industry 1.3 Globalization □ Introduction □ Advantages & disadvantages w.r.t. India 1.4 Intellectual Property Rights (I.P.R.)	04	
02	**Management Process** 2.1 What is Management?	05	

	□ Evolution □ Various definitions □ Concept of management □ Levels of management □ Administration & management □ Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management □ Planning □ Organizing □ Directing □ Controlling 2.4 Social responsibility and Environmental dimension of management		
GROUP:B			
03	**Organizational Management** 3.1 Organization :- □ Definition □ Steps in organization 3.2 Types of organization □ Line □ Line & staff □ Functional □ Project 3.3 Departmentation □ Centralized & Decentralized □ Authority & Responsibility □ Span of Control 3.4 Forms of ownership □ Propriotership □ Partnership □ Joint stock □ Co-operative Society □ Govt. Sector	06	
04	**Human Resource Management** 4.1 Personnel Management □ Introduction □ Definition □ Objectives □ Functions 4.2 Staffing □ Introduction to HR Planning □ Recruitment Procedure 4.3 Personnel– Training & Development □ Types of training □ Induction □ Skill Enhancement 4.4 Grievance handling 4.5 Leadership & Motivation □ Maslow's Theory of Motivation 4.6 Safety Management □ Causes of accident □ Safety precautions 4.7 Introduction to – □ Factory Act	10	

	□ ESI Act □ Workmen Compensation Act □ Industrial Dispute Act		
GROUP:C			
05	**Financial Management** 5.1. Financial Management- Objectives & Functions 5.2. Capital Generation & Management □ Types of Capitals □ Sources of raising Capital 5.3. Budgets and accounts □ Types of Budgets □ Production Budget (including Variance Report) □ Labour Budget □ Different financial ratios. □ Introduction to Profit & Loss Account (only concepts) ; Balance Sheet 5.4 Introduction to – □ Excise Tax □ Service Tax □ Income Tax □ VAT □ Custom Duty	09	
06	**Materials Management** 6.1. Inventory Management (No Numerical) □ Meaning & Objectives 6.2 ABC Analysis 6.3 Economic Order Quantity(EOQ) 6.4 Stores function, Stores system, BIN card, Materials issue request(MIR), Pricing of materials □ Introduction & Graphical Representation 6.4 Purchase Procedure □ Objects of Purchasing □ Functions of Purchase Dept. □ Steps in Purchasing 6.5 Modern Techniques of Material Management □ Introductory treatment to JIT / SAP / ERP	09	
07	**Safety Engineering** 7.1 Accidents-causes of accidents, Welfare measures. 7.2 Need for safety 7.3 Organization for safety 7.4 Safety committee 7.5 Safety programmes 7.6 Safety measures	05	
	Total	**48**	

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Dr. O.P. Khanna	Industrial Engg & Management		Dhanpat Rai & sons New Delhi
V.Arun Viswanath, Anoop. S. Nair, S.L.Sabu	Industrial Engineering and Management		SCITECh Publication(s) Pvt. Ltd

A. Bhat & A. Kumar	Management Principles, Processes & Practices		Oxford University Press
Dr. S.C. Saksena	Business Administration & Management		Sahitya Bhavan Agra
W.H. Newman E.Kirby Warren Andrew R. McGill	The process of Management		Prentice- Hall
Rustom S. Davar	Industrial Management		Khanna Publication
Banga & Sharma	Industrial Organisation & Management		Khanna Publication
Jhamb & Bokil	Industrial Management		Everest Publication , Pune

Suggested List of Assignments/Tutorial :-

1. Preparation of financial budget of any organization.

2. Preparation of chart for fire safety.

3. Preparation of chart for personal, Tools & Equipments and products safety.

4. Preparation of chart to avoid accident.

5. Preparation of chart to show the different financial ratios.

6. Preparation of chart to show the different types of organization.

End Semester Examination Scheme. Maximum Marks-70, Time Allotted-3 hrs							
Group	**unit**	**Objective Questions**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer**	**Marks per question**	**Total marks**
A	**01,02**	**7**		**3**			
B	**03,04**	**7**	**25**	**3**	**5, taking at least one from each group**	**10**	**50**
C	**05,06,07**	**11**		**4**			

Note : For any modification of contents please refer www.webscte.org/syllabus.html of **"Industrial Management"**

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Name of the subject: INDUSTRIAL AUTOMATION (Elective)	
Subject Code: EE/S6/IA (EL)	**Semester: Sixth**
Duration: one Semester	**Maximum Marks: 150**
Teaching Scheme	**Examination Scheme**
Theory : 3 hrs/week	Mid Semester Exam: 20 Marks
Tutorial: - hrs/week	Assignment & Quiz: 10 Marks
Practical : 2 hrs/week	End Semester Exam: 70 Marks
Credit: 04	Practical : 50 Marks

Aim:

Sl. No.	
1.	To explain applications of control systems / Automation
2.	Design & program PLC using Ladder logic.
3.	To study working of control components

Objective:

Sl. No.	Student will be able to
1.	• Explain applications of control systems / Automation.
2.	• Explain the hydraulic/ pneumatic systems.
3.	• Describe & program PLC using Ladder logic.
4.	• Describe working of control components.
5.	• Draw power & control circuit.

Pre-Requisite:

Sl. No.	
1.	Control system
2.	Basic Electronics
3.	AC, DC motors

	Contents (Theory)	Hrs./Unit	Marks
Unit: 1	**Automation** 1.1 Need of automation 1.2 Advantages of automation 1.3 Requirements of automation	02	
Unit: 2	**Control System** 2.1 Use of control system in automation. 2.2 Different types of control system in automation. 2.3 Development of block diagram for simple applications like level, temperature, flow, speed control.	04	04

Unit: 3	**Control System Components** 3.1 Contacts-types, current capacity & load utilization categories 3.2 Solenoids-dc, ac 3.3 I/P devices- switches-push buttons, foot switch, selector switch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing 3.4 Relays- electromechanical, reed 3.5 O/P devices- contactors, valves, pilot lamps 3.6 Symbols in power & control circuits 3.7 Developing control circuit-basic & thumb rule 3.8 Power & control circuit for different applications like hoist, crane, conveyer belt, induction motors	08	12
Unit: 4	**Application of Electrical Actuators in control system:** 4.1 Potentiometers in control system. 4.2 Servomotors-AC & DC with their working principle. 4.3 Synchros - Transmitter, Control transformer, use as error detector. 4.4 Stepper motor-PM & variable reluctance- working principle. 4.5 Tacho generator – AC & DC. 4.6 Applications of above components as AC/DC control system.	08	10
Unit: 5	**Controllers** 5.1 Hydraulic-advantages & disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals 5.2 Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic & hydraulic systems 5.3 Electrical & electronic controller- lead-lag networks. 5.4 Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller	08	10
Unit: 6	**Control actions** 6.1 On-Off, P, I, P+I, P+D,P+I+D, actions 6.2 P+I+D action using hydraulic, pneumatic electronic controller 6.3 Tuning of P+I+D controller	06	10
Unit: 7	**Programmable Logic Controller** 7.1 Role of PLC in automation. 7.2 PLC Vs PC in automation. 7.4 Block diagram of PLC. 7.5 Basic blocks like CPU, I/O modules, bus system, power supplies & remote I/Os. 7.6 Different PLC's available in market.	08	10
Unit: 8	**Programming of PLC** 8.1 Development of Ladder logic 8.2 Some simple programs such as I/O connections, starting of IM, stepper motor control.	02	10
Unit: 9	**Introduction to special control systems** 9.1 Distributed Control System(DCS)-brief introduction to hardware & software used 9.2 SCADA- brief introduction to hardware & software used.	02	04
	Total	**48**	**70**

Contents (Practical)	
Sl. No.	Skills to be developed

1.	Intellectual Skills: a. Logical development b. Programming skills
2.	Motor Skills: a. Interpretation skills b. Connecting properly

List of Practical: (At least Eight experiments are to be performed)

Sl. No.	
1.	a) To plot the characteristics of potentiometer. b) Use of potentiometer as error detector.
2.	To plot V-I characteristics of DC & AC servomotors. compare them with DC & AC motor characteristics.
3.	a) To plot the characteristics of synchro transmitter. b) Use of synchro transmitter- control transformer pair as error detector.
4.	To measure step angle of a stepper motor in forward & reverse direction.
5.	Observe various components /parts/symbols/connections of a PLC.
6.	To perform Forward and Reverse operation of 3 phase Induction Motor using PLC.
7.	To perform stepper motor/ temperature control using PLC.
8.	To Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.
9.	To build P, I, PI, PD & PID controller using op-amps & R-C circuits. Plot V-I characteristics.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Nagrath Gopal	Control System Engg.		Wiley Eastern
K.Ogata	Modern Control Engg.		Prentice Hall
Jacob	Industrial Control Engg		Prentice Hall
Andrew Parr	Hydraulics & Pneumatics		Jaico Publication
Webb & Reis	Programmable Logic Controller: Principle applications		Wiley Eastern
S.K. Bhattachrya Brijinder Singh	Control of Electrical Machines		New Age International Publishers
Jon stenerson	Industrial automation and process control		Prentice Hall
Richad Shell	Handbook of Industrial automation		Taylor and Francis

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	5,6,7,8,9	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

3. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
4. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the subject : Control of Electrical Machines (Elective)	
Subject Code : EE/S6/CEM(EL)	**Semester : Sixth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:	
Sl. No.	
1.	This subject is the combination of Electrical machine and Control system. Most of the motor control circuits are based on these systems.
2.	Understanding of the subject will provide skill to the students of different motor control systems and their applications in industry.

Objective:	
Sl. No.	Student will be able to:
1.	Interpret the basics of the motor control systems.
2.	Demonstrate the solid state control of motor.
3.	Describe the implementation of PLC in control systems.

Pre-Requisite:	
1.	Knowledge of Electrical machine.
2.	Knowledge of Control system.

	Contents (Theory):	Hrs./Unit	Marks
Unit : 1	**1. Control Systems :** 1.1 Concept of Automatic control system. 1.2 Illustration of Open loop and closed loop control system. 1.3 Need for feed back system. 1.4 Basic elements of a servo mechanism. 1.5 Examples of Automatic control system. 1.6 Introduction to solid state control. 1.7 Advantages of solid state control of machines.	**08**	**12**
Unit : 2	**2. Magnetic Control Systems:** 2.1 Operation & Applications of Contactor control circuit components – (i) Switches – Push button type, Selector type, Limit switch, Pressure, Float type, Proximity, Thermostat (Temperature) (ii) Fuses – Kit-kat type, Cartridge type, HRC type (iii) MCCB, MCB. (iv) Electromagnetic Contactor. (v) Overload relays – Voltage operated, Current operated, Thermal overload relay, Magnetic overload relay, (vi) Time delay relays (OFF delay, ON delay). (vii) Timer – Pnumatic type, Electronic type.	**10**	**14**

	(viii) Relays –Frequency response relay, Latching relay, Phase failure relay (single phase preventer), Solid state relay. (ix) Solenoid valve. 2.2 Principles of design of motor control circuits and power circuits.		
Unit : 3	**3. MAGNETIC CONTROL OF DC MOTOR:** 3.1 Operation of Control circuit & Power circuits of - (i) Jogging operation of DC motor in one and two directions. (ii) Starters of DC motor - Current limit accleration starter, Series relay & Counter emf starter, Definite time accleration starter. (iii) Braking of DC motor - Dynamic braking , Reversing & plugging. (iv) Protection of DC motor - Field failure protection circuit, Field accleration protection circuit, Field deceleration circuit. **3.2 Solid State Control of DC Motor :** (i) Speed control of DC motor using chopper circuit. (ii) Speed control of DC shunt motor using thyristor- Half-wave drives & Full-wave drives.	**10**	**14**
Unit : 4	**4. MAGNETIC CONTROL OF AC MOTOR:** 4.1 Operation of Control circuit & Power circuits of - (i) Reversing the direction of rotation of induction motor with Interlocking systems (ii) Simple ON-OFF motor control circuit, (iii) Automatic Sequencial control of motor. (iv) DOL starter, (v) Automatic Auto-transformer starter, (vi) Automatic Star-Delta starter. (vii) Starter for multispeed operation of motor. (viii) Plugging & Dynamic braking of AC motor. (ix) Protection of AC motor – Overload, Short circuit and Over temperature protection of high rating motors. **4.2 Solid State Control of AC Motor:** (i) Speed control of three phase induction motor using variable voltage frequency control, (ii) Speed control of slip-ring induction motor using variable rotor circuit resistance. (iii) Speed control of single phase induction motor using thyristor. (iv) Speed control of synchronous motor. (v) Speed control of universal motor.	**10**	**14**
Unit : 5	**5. Use of Programmable Logic Control (PLC):** 5.1 Introduction & Advantages of PLC. 5.2 Function of each part of PLC. 5.3 Hardware of PLC. 5.4 Concept of Ladder diagram in PLC programming. 5.5 Ladder logic diagram for – (i) DOL starter of Induction motor, (ii) Automatic Star-Delta starter of Induction motor, (iii) Sequential operation of three motors with a time gap, (iv) Fluid filling operation. 5.6 Use of PLC in closed loop control, Proportional control,	**10**	**16**

	Integral control, Derivative control & PID control with illustration. 5.7 DC motor speed control using PLC programming.		
	Total	**48**	**70**

Practical:

Skills to be developed:

Intellectual Skills:

1. To select appropriate component and equipment.
2. Apply different designing skills.

Motor Skills:

1. Ability to draw the control & power circuit diagrams.
2. Ability to interpret the circuits and waveforms.

List of Practical: (At least Eight experiments are to be performed)

1. To study control components - Electromagnetic contactor, Thermal overload relay, Timer (OFF delay, On delay), Push button Switches, Solenoid valve, MCB.
2. To make & test the control and power circuit for Jogging operation, forward & reverse rotation of Sq.cage induction motor using contactor control.
3. To make & test the control and power circuit for fully-automatic star-delta starter operation of cage induction motor using contactor control.
4. To make & test the control circuit for dynamic braking operation of induction motor using contactor control.
5. To make & test the working of single phase preventer using contactor control.
6. To control speed of DC shunt motor using SCR drive.
7. To make & test the control circuit operation of DOL starter of induction motor using PLC.
8. To make & test the control circuit operation of automatic star-delta starter of induction motor using PLC.
9. To study the Speed control of DC shunt motor with PID control using PLC.
10. To make & test the control circuit operation of three sequential motor operations using PLC.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	S.K.Bhattacharya	Industrial Electronics and Control	T.M.H.
2.	Dr. S.K.Sen	Electrical Machine	Khanna Publisher
3.	V. Subrahmanyam	Electric Drives – concepts & applications	T.M.Hill
4	Petruzella	Programmable Logic Controller	T.M.Hill

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	4,5	11				FOUR			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the subject : Process Control & Instrumentation (Elective)	
Subject Code : EE/S6/PC(EL)	**Semester : Sixth**
Duration : One Semester	**Maximum Marks : 150**
Teaching scheme :	**Examination scheme :**
Theory: 3 Hrs./ Week	Mid Semester Exam: 20 Marks
Practical: 2 Hrs./ Week	Assignment & Quiz: 10 Marks
	End Semester Exam: 70 Marks
	Practical: 50 Marks
Credit: 04	

Aim:	
Sl. No.	
1.	This subject is the combination of control system and instrumentation. Most of the subjects of Electrical Engineering are based on these systems.
2.	Understanding of the subject will provide skill to the students of different process control systems and their use in industry.

Objective:	
Sl. No.	Student will be able to:
1.	Know about the basics of the process control systems.
2.	Know about the digital Data Acquisition System.
3.	Learn about the use of PLC in control systems.
4.	Know about the digital Data Transmission Systems.

Pre-Requisite:	
1.	Knowledge of control system.
2.	Knowledge of Instrumentation.

	Contents (Theory):	Hrs./Unit	Marks
Unit : 1	**1. Process Control System:** 1.1 Introduction to the terminology of process control system – Balanced condition, Self-regulation, Process disturbance, Process time lag, Process reaction curve. 1.2 Block diagram of a process control system. 1.3 Realization of control actions using P, PI, PD, PID controller. 1.4 P, I, D actions with Pneumatic, Hydraulic and Electronic systems, Amplifiers. 1.5 Concept of Feedback and feed forwards control systems, Ratio control, Cascade control. 1.6 Control valves and Actuator.	**10**	**14**
Unit : 2	**2. Measurement of Non Electrical Quantity:** 2.1 Basic requirements of a transducer. 2.2 Measurement of Pressure: Manometer, Bellows, Bourdon tube, Capacitance type differential pressure transducer. 2.3 Measurement of Temperature: Resistance temperature detector, Thermocouple, Pyrometer. 2.4 Measurement of Flow: Rotameter, Electromagnetic flow meter, Hot wire anemometer.	**10**	**14**

	2.5 Measurement of liquid level. 2.6 Measurement of Humidity - Hygrometer. 2.7 Measurement of Viscosity. 2.8 Gas analyser. 2.9 Measurement of pH.		
Unit : 3	**3. Data Acquisition System:** 3.1 Basic components of Data Acquisition System. 3.2 Components of a PC-based Data Acquisition System. 3.3 Analog input & output subsystem. 3.4 Digital input & output subsystem. 3.5 Single channel data acquisition system. 3.6 Multi channel data acquisition system. 3.7 Concept of Distributed Control System (DCS, DDC). 3.8 IEEE 488 Interface.	**10**	**12**
Unit : 4	**4. Data Transmission Element / Telemetry:** 4.1 Land line telemetry 4.2 Voltage and current telemetering, two wire current transmitter. 4.3 Time division multiplexing, synchros, modem, synchronous and asynchronous communication. 4.4 RF telemetry. 4.5 Modulation methods – Amplitude modulation, Frequency modulation, Pulse width modulation. 4.6 Pulse code modulation (PAM) Telemetry.	**06**	**12**
Unit : 5	**5. Spectrum Analyzer:** 5.1 Basic principle. 5.2 Block diagram. 5.3 Low cost Spectrum Analyser. 5.4 Experiments with low cost components. 5.5 Concept of spectrum analysis software.	**06**	**08**
Unit : 6	**6. Use of Programmable Logic Control (PLC) in process control:** 6.1 Introduction & Advantages of PLC. 6.2 Function of each part of PLC. 6.3 Hardware of PLC. 6.4 PLC operation & Program execution. 6.5 Application of PLC in process control – Pressure, Temperature, Liquid level control.	**06**	**10**
	Total	**48**	**70**

Practical:
Skills to be developed:
Intellectual Skills:
1. To select appropriate equipment.
2. Apply different designing skills.
Motor Skills:
1. Ability to draw the circuit diagrams.
2. Ability to interpret the circuits and waveforms.

List of Practical: (At least Eight Experiments are to be performed)

1. To study of a bourdon tube, manometer and bimetallic transducer.
2. To measure fluid pressure using manometer.
3. To monitor and control of temperature using bimetal.
4. To study of different telemetering systems with the help of slide / model.
5. To study of AM, FM, PWM using trainer kit.
6. To study of a temperature controller and its application in temperature control circuit.
7. To study a typical pneumatic control system.
8. To study of Data Acquisition System using slide.
9. To study distributed digital control using 8085 microprocessor / microcontroller.
10. To make and execute circuit of any process control system using PLC programming.
11. To apply PID controller in a process control system and observe the output with variation of input using MATLAB software.
12. Visit to a nearby Process Control Industry and study the control process with its allied components.

List of Text Books:

Sl. No.	Name of Author	Title of the Books	Name of Publisher
1.	Eckman	Automatic Process Control	Wiley Eastern
2.	D. Patranabis	Principle of Process Control	T.M.H.
3.	Purkait	Electrical & Electronics Measurements & Instrumentation	T.M.H.
4.	Curtis Johnson Ltd.	Process Control Instrumentation	P.H.I. Ltd.
5.	Petruzella	Programmable Logic Controller	T.M.Hill

E X A M I N A T I O N S C H E M E (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2	11	TWENTY	ONE	1 X 20 = 20	FOUR	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	3,4,5,6	12				FIVE			

Note: Paper-setter should take into account the marks which have been allotted in each unit and set the paper accordingly so that all units get the importance as allotted.

E X A M I N A T I O N S C H E M E (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
2. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject: Computer Hardware and Networking (Elective)	
Subject Code: EE/S6/CHN (EL)	**Semester: SIXTH**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/Week	Mid Semester Exam.: 20 Marks
Tutorial:	Assignment & Quiz: 10 Marks
Practical: 2 Hrs/Week	End Semester Exam.: 70 Marks
Credit: 04	Practical : 50 Marks

Aim:

Sl. No.	
1.	To Identify various components of PC
2.	To study construction, working and function of different peripheral devices.
3.	To study Networking basic and know how to set up Local Area Network

Objective:

Sl. No.	
1.	• Identify various components of PC.
2.	• Describe the construction, working and function of different peripheral devices.
3.	• Read and interpret documentation .
4.	• Assemble the PC and connect the modules.
5.	• Install system software, application software and drivers.
6.	• Set up Local Area Network.

Pre-Requisite:

Sl. No.	
1.	Digital Electronics
2.	

Contents (Theory)		Hrs./Unit	Marks
Unit: 1	**Introduction**: PC system units – Front Panel / Rear side connectors, switches and indicators -specification parameters - Lap top PCs – Palm top PCs.	02	04
Unit: 2	**Inside PC** 2.1 Inside PC – functional blocks of mother board – CPU, RAM, BIOS, Cache RAM, BUS extension slots, on-board I/O and IDE connectors PCI, AGP & PCI express. 2.2 BIOS, services, organization and interaction. 2.3 CMOS, CMOS setup utilities, CMOS setup program. 2.4 Motherboard types. 2.5 Processors – CISC and RISC. 2.6 Features of Pentium 4 processor, Pentium Celeron processor, CYRIX series processors, AMD series processors. 2.7 Chipsets – features of Intel 854, 915 series chipset motherboards 2.8 Bus standard and Bus architecture 2.9 Power supplies –SMPS for Computers, Power requirements in PCs.	12	16

Unit: 3	**On board memory, I/O interface and storage device** 3.1 PC's memory organization 3.2 ROM, RAM, distinguish between static and dynamic RAM 3.3 DRAM, Synchronous DRAM, Cache Memory, Extended/ Expanded/Virtual memory. 3.4 I/O port – Serial port, Parallel port, USB port 3.5 Hard disk drives : Functional block diagram, SATA technology. 3.6 CD-ROM drive – Principle of operation, block diagram. 3.7 DVD technology – DVD disks, DVD drive, block diagram. 3.8 Pen drives.	05	8
Unit: 4	**Input and Output Devices** 4.1 Keyboard – types, operation, and keyboard signals, interface logic, keyboard functions. 4.2 Mouse – principle of operation, mouse signals, optical mouse, mouse installation. 4.3 Scanner – principle of operation, types. 4.4 Digital display technology (thin displays) – Liquid crystal displays, Plasma displays, TFT monitors. 4.5 **Modem:** Introduction – functional block of modem – working principle – types – installation. 4.6 Dot matrix printer – principle of operation. 4.7 LASER printer – principle of operation 4.8 Ink-jet printer- principle of operation, 4.9 Plotter – types, functional block diagram.	05	7
Unit: 5	**Computer Network Basics:** Introduction – OSI layer model – Function of each layer network types – LAN- WAN– MAN – internet – intranet – extranet – Blue tooth Technology. **TCP/IP**: Introduction, History of TCP/IP, Function of each layer of TCP/IP, User Datagram Protocol, Comparison of OSI and TCP/IP. IP Addressing, IP address classes, Subnet Addressing, Domain Name System, Email – SMTP, POP,IMAP; FTP, HTTP, Overview of IP version 6.	12	16
Unit: 6	**Network Media& Hardware** Twisted wire - Coaxial cable - fiber optic cable, VSAT **Local Area Network:** Introduction to LANs, Features of LANs, Components of LANs, Usage of LANs, LAN topologies – star – ring – mesh – bus – Client/Server – peer to peer. IEEE 802 standards, Ethernet, LAN interconnecting devices: Hubs, Switches, Bridges, Routers, Gateways.	08	12
Unit: 7	**Cryptography** : Encryption, Decryption, Asymmetric Key and Symmetric Key Cryptography, Digital Signature.	04	7
	Total	**48**	**70**

Contents (Practical)

Sl. No.	Skills to be developed
1.	Intellectual Skills: i) Identify various components of Computer ii) Able to prepare a block diagram to correlate all the components based on their functions
2.	Motor Skills: i) Able to use the various tools efficiently ii) Able to set Local Area Network.

List of Laboratory Experiments:	
Sl. No.	Laboratory Experiments
1.	Connecting & disconnecting computer peripherals and components & driver installation (For example Printer/Modem/DVD/Scanner etc.)
2.	To carry out Hard disk partitioning and formatting.
3.	To install operating System like Windows 7 / Linux (Ubuntu)
4.	To change the Standard settings and advanced settings (BIOS and Chipset features) of CMOS set up Program.
5.	To install the Network Interface Card and Familiarize with O Networking cables (CAT5, UTP) o Connectors (RJ45, T-connector) o Hubs, Switches
6.	To carry out Straight Through and Cross Over Cable connection with RJ 45 and CAT 5 cable
7.	To set up a Local area Network with 5 nos. of computers.
8.	To share Printer, Folder and Drives.

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Vikas Gupta	Hardware and Networking Course Kit		Dreamtech Press
Steve Rackley	Networking in easy steps		Dreamtech Press
Behrouz A. Forouzen	Data communication and Networking		Tata Mc. Graw-Hill Publishing Co. Ltd.
D Bala Subramanian	Computer Installation and Servicing		TMH, New Delhi
Mike Meyers, scott Jernigan	Managing and troubleshooting PCs		TMH, New Delhi
Bhushan Trivedi	Computer Network		Oxford University Press

EXAMINATION SCHEME (THEORITICAL)

GROUP	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	**TO BE ANSWERED**	MARKS PER QUESTION	TOTAL MARKS
A	1, 2, 3,4	12	TWENTY	ONE	1 X 20 = 20	FIVE	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	TEN	10 X 5 = 50
B	5,6,7	11				FOUR			

EXAMINATION SCHEME (SESSIONAL)

3. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Sixth Semester. **Distribution of marks: Performance of Job – 15, Laboratory Notebook – 10.**
4. **External Assessment of 25 marks** shall be held at the end of the Sixth Semester on the entire Sessional syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**

Name of the Subject: Professional Practices IV	
Subject Code: EE/S6/PFIV	**Semester: Sixth**
Duration: one Semester	**Maximum Marks: 50**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.: Marks
Tutorial:	Assignment & Quiz: Marks
Practical: 4 hrs / week	End Semester Exam.: Marks
	Practical : 50 Marks
Credit: 2	

Aim:

Sl. No.	
1.	To acquire information from different sources
2.	To present a given topic in a seminar, discuss in a group discussion
3	To prepare report on industrial visit, expert lecture.

Objective:

Sl. No.	The student will be able to
1.	Acquire information from different sources
2.	Prepare notes for given topic
3.	Present given topic in a seminar
4	Interact with peers to share thoughts
5	Prepare a report on industrial visit, expert lecture

Pre-Requisite:

Sl. No.	
1.	Knowledge of studying 5 semesters in Diploma Engineering

Activities

Sr . No.	Activities	Hours
1.	Industrial / Field Visit : Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to **<u>any ONE</u>** from the list below (<u>should not have completed in earlier semester</u>): i) Multistoried building for power distribution ii) Any industry with process control and automation iii) District Industries Centre (to know administrative set up, activities, various schemes etc) iv) Railway / metro railway signaling system v) Motor rewinding in a motor rewinding shop vi) Visit warehouse / Rail yard / port and observe Material Handling Management & documentation.	**12**

	vii) A thermal / Hydel power generating station viii) A Wind mill and / or Hybrid power station of wind and solar ix) An electrical substation x) A switchgear manufacturing / repair industry xi) Protection system in a large industry. xii) Visit to maintenance dept of a large industry. xiii) A large industry to study protection system xiv) Industry of power electronics devices xv) Transmission tower project area xvi) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xvii) A large industry to study protection system xviii) Industry of power electronics devices xix)Transmission tower project area xx) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xix) Any other technical field area as may be found suitable alternative to above list.	
2.	**Guest Lecture by professional / industrial expert**: The guest lecture (s) **any three** of two hours duration each from the field /industry experts, professionals or from experienced faculty members(from own department or other departments) will be encouraged) are to be arranged from the following or alike topics. A brief report to be submitted on the guest lecture by each student as a part of term work. **<u>Group A (at least one)</u>** i) Career opportunities for diploma engineers ii)Industrial Dispute and Labour Laws iii) Challenges in industrial working environment for diploma engineers iv) Scope for diploma electrical engineers v) Working in shopfloor. vi) Oppurtunities in the service sector vii) Any other topic of relevance as may be deemed fit for fresh engineers as he starts his career in industry. **<u>Group B (at least one)</u>** i) Eco friendly air conditioning / refrigeration. ii) Modern trends in AC machine iii)Testing of switchgear iv)Biomedical instruments – working, calibration etc. v)Automobile pollution, norms of pollution control. vi)nanotechnology vii) Modern techniques in Power Generation viii) New trends in power electronics devices ix)TQM	**12**

	x)Recent modification in IE rules xi)standardization / ISO certification xii)Role of micro, small and mediun enterprise. In Indian economy. xiii)Entrepreneurship development and oppurtunities xiv) Interview techniques xv)**Any topic that could not be covered in earlier semesters and having relevance to technical knowledge gathered in all semesters.**	
3.	**Information search** Information search can be done through manufacturers, catalogue, internet, magazines, books etc and a report need to be submitted. Can be done in a group of 2/3 students Topic suggested (**any two**)Teachers may assign work on any other cross disciplinary subjects for enrichment of knowledge outside course work of Electrical discipline) 1. Blue tooth technology 2. Artificial technology 3. Data warehousing 4. Cryptography 5. Digital signal processing 6. Bio-informatics 7. Magnetic levitation system 8. Recent development in electrically operated vehicles for mass transport 9. Comparative study of metro railway in Kolkata and Delhi 10. Alternative fuel and energy options 11. Comparison of transformer companies 12. Latest trends in classification of insulating materials 13. Design consideration for dry type transformers 14. State and national statistics of power generation 15. Market survey of contactors, relays and their comparative analysis. 16. Market survey of any other electrical product which must include among other things various manufacturers, cost, specification, application areas etc.	**12**
4.	**Group Discussion** The students should discuss in a group of six to eight students. Each group to perform **<u>any TWO</u> group discussions**. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At	**14**

	the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested topics are – i) Scope of outsourcing of electrical Engineering services. ii)Pollution Control iii) Rain water harvesting iv) Trends in energy conservation v) Safety in day to day life vi) Use of plastic carry bag (social & domestic Hazard) vii)Pollution control viii) Any other common topic related to electrical field as directed by concerned teacher.	
5.	**Seminar / Poster presentation:** Students should select a topic for seminar based on recent development in Electrical Engineering fields, emerging technology etc. Concerned Teachers will guide students in selecting topic.	**14**

EXAMINATION SCHEME (SESSIONAL)

Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the sixth semester. Distribution of marks: Information search = 10, seminar = 10, Group doscussion = 5, field visit = 10, guest lecture attendance and report = 15

Name of the Subject: General Viva Voce	
Subject Code: EE/S6/GVV	**Semester: SIXTH**
Duration: one Semester	**Maximum Marks:**
Teaching Scheme	**Examination Scheme**
Theory:	Mid Semester Exam.:
Tutorial:	Assignment & Quiz:
Practical:	End Semester Exam.:
Credit: 02	Practical : 100 Marks

Aim:

Sl. No.	
1.	It is required to revisit the contents of the departmental subjects learnt by the students up to sixth semester.
2.	As a diploma holder of Electrical Engineering, students should be able to co relate the various ideas and concepts learnt from various subjects throughout the course duration.
3.	Student should equip themselves to face various types of technical questions during various competitive examinations/ Interview Board.

Contents (Theory)

The syllabi of all the theoretical and sessional subjects taught in the three years of diploma education

E X A M I N A T I O N S C H E M E (SESSIONAL)

The Final Viva-Voce Examination shall take place at the end of Sixth Semester. It is to be taken by Faculty members of the Institute concerned.