Study & Evaluation Scheme

of

Diploma in Engineering
(ELECTRICAL ENGINEERING)

[Applicable w.e.f. Academic Session 2024-25]

Approved by Academic Council

FUTURE UNIVERSITY

18th Milestone, Bareilly-Lucknow Highway NH-24
Near Faridpur, Bareilly, Uttar Pradesh 243503
Website: www.futureuniversity.in

FUTURE UNIVERSITY

(Established under Govt. of U. P. Act No. 12, 2024)

Study & Evaluation Scheme
of
Diploma in Engineering (ELECTRICAL ENGINEERING)
SUMMARY

Programme : Diploma in Engineering (ELECTRICAL ENGINEERING)

Duration : Three years full time (Six Semesters)

Medium : English/ Hindi

Minimum Required Attendance : 75 percent

Credit

Maximum Credit : **132**

Minimum credit required for the degree : **120**

Assessment (Theory) :

Internal	External	Total
30%	70%	100%

Assessment (Practical) :

Internal	External	Total
30%	70%	100%

Internal Evaluation (Theory Papers)

Class Test I	Class Test II	Assignment(s)	Other Activity (including attendance)	Total
10 Marks	10 Marks	5 Marks	5 Marks	30 Marks

Internal Evaluation (Practical Papers)

Experiment File Viva	Mid Semester Exam	Attendance	Total
10 Marks	10 Marks	10 Marks	30 Marks

Duration of Examination (Theory) :

External	Internal
3 hrs.	1 ½ hrs

Duration of Examination (Practical) **:** As per the requirement of the practical paper.

To qualify the course a student is required to secure a minimum of 40% marks in aggregate including the semester end examination and teachers' continuous evaluation. (i.e. both internal and external).
A candidate who secures less than of 40% of marks in a course shall be deemed to have failed in that course. The student should have at least 50% marks in aggregate to clear the semester. In case a student has more than 40% in each course, but less than 50% overall in a semester, he/she shall re-appear in courses where the marks are less than 50% to achieve the required aggregate percentage of 50% in the semester.

Question Paper Structure

1. ***The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weight age 4 marks each).***
2. ***Out of the rest five questions, students shall be required to attempt all five questions, but there will be an internal choice of A or B. Each question will be from one unit of the syllabus. The weight age of Question No. 2 to 6 shall be 10 marks each.***

Faculty of Engineering & Technology

Department of Diploma in Engineering

Electrical Engineering

Evaluation Scheme

Credit Framework for Diploma in Engineering - NEP-2020									
Sem.	**Major (Core)**	**Minor Stream**	**Multidisciplinary**	**Ability Enhancement course**	**Skill Enhancement Course**	**Value added Courses Common for All Diploma**	**Summer Internship**	**Research Project/Dissertation**	**Total Credit**
1.	14	5			3	2			24
2.	17	4	2			1			24
3.	10	4	2		5	1			22
4.	14			3		3	2		22
5.	13		3	3		1			20
6.	17					1		2	20

Total Credit- 132

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester I

							Evaluation Scheme					
SN	Subject Name	Type	Category	Period			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total	Credit
				L	T	P	CT	TA	CT+TA	TE/PE	SW+ESE	Cr
1.	Mathematics-I	T	Major (Core)	3	1	-	20	10	30	70	100	4
2.	Applied Physics-I	T	Major (Core)	3	1	-	20	10	30	70	100	4
3.	Applied Chemistry	T	Major (Core)	3	1	-	20	10	30	70	100	4
4.	Communication Skills in English	T	Skill Enhancement	3	-	-	20	10	30	70	100	3
5.	Applied Physics Lab	P	Minor Stream	-	-	4	-	20	20	30	50	2
6.	Applied Chemistry Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
7.	Communication Skills Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
8.	Engineering Graphics	P	Major (Core)	-	-	4	-	20	20	30	50	2
9.	Engineering Workshop Practice Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
10.	General Proficiency	-	Value Added	-	-	2	-	50	50	-	50	1
11.	Sports & Yoga	-	Value Added	-	-	2	-	20	20	30	50	1
	Total			**12**	**3**	**18**	**80**	**210**	**290**	**460**	**750**	**24**

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester II

							Evaluation Scheme					
SN	**Subject Name**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Mathematics-II	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
2.	Applied Physics-II	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
3.	Introduction to IT System	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Fundamentals of Electrica l& Electronic Engineering	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
5.	Engineering Mechanics	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
6.	Environmental Sciences	**T**	Multidisciplinary	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	Applied Physics-II Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Introduction to IT System Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Fundamentals of Electrical Electronic Engineering Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
10.	Engineering Mechanics Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
11.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**15**	**4**	**10**	**120**	**190**	**310**	**540**	**850**	**24**

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester III

							Evaluation Scheme					
SN	**Subject Name**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Applied Mathematics-III	**T**	Minor Stream	3	1	-	20	10	**30**	**70**	**100**	**4**
2.	Communication Skill-II	**T**	Skill Enhancement	3	-	-	20	10	**30**	**70**	**100**	**3**
3.	AI For Everyone	**T**	Skill Enhancement	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Electrical Instrumentation and Measurement	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
5.	Electrical Machine-I	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
6.	Environmental Studies	**T**	Multidisciplinary	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	Electrical Instrumentation LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Electrical Machine-1 LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**16**	**3**	**6**	**120**	**150**	**270**	**480**	**750**	**22**

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester IV

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Industrial Training	-	Summer Training	-	-	-	-	50	**50**	-	**50**	**2**
2.	Industrial Electronics and Control	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
3.	Electrical Design, Drawing and Estimating-I	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
4.	Transmission and Distribution of Electrical Power	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
5.	Energy Conservation	**T**	Ability Enhancement	3	-	-	20	10	**30**	**70**	**100**	**3**
6.	AI for Engineering	**T**	Major (Core)	3	-	-	20	10	**30**	**70**	**100**	**3**
7.	Universal Human Values	**T**	Value Added	2	-	-	20	10	**30**	**70**	**100**	**2**
8.	Electrical Design, Drawing and Estimating-I LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Transmission and Distribution of Electrical Power LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
10.	General Proficiency	-	Value Added	-	-	2	-	50	**50**	-	**50**	**1**
	Total			**14**	**3**	**6**	**120**	**200**	**320**	**480**	**800**	**22**

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester V

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Switchgear and Protection	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
2.	PLC, Microcontroller and SCADA	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
3.	Electrical Machine-II	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
4.	Renewable Source of Energy*	**T**	Ability Enhancement	3	-	-	20	10	**30**	**70**	**100**	**3**
5.	Power Plant Engineering	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
6.	Industrial Management and Entrepreneurship Development	**T**	Multidisciplinary	3	-	-	20	10	**30**	**70**	**100**	**3**
7.	PLC, Microcontroller and SCADA LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Electrical Machine-II LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**14**	**3**	**6**	**120**	**150**	**270**	**480**	**750**	**20**

Note: - (*) – Elective Subject

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

Polytechnic (Diploma in Engineering), Semester VI

							Evaluation Scheme					
SN	**Subject Name**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Installation, Maintenance and Repair of Electrical Equipment	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
2.	Electrical Design, Drawing and Estimating II	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
3.	Utilization of Electrical Energy	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Application of computer software in Electrical Engineering	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
5.	Digital Electronics	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
6.	Electrical and Electronics Engineering Materials	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
7.	Electrical Design, Drawing and Estimating II LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Installation, Maintenance and Repair of Electrical Equipment LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Project Work	**p**	Project	-	-	4	-	50	**50**	**200**	**250**	**2**
10.	General Proficiency	**-**	Vale Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**12**	**3**	**10**	**120**	**200**	**320**	**680**	**1000**	**20**

MATHEMATICS - I

L	*T*	*P*
3	1	-

COURSE OBJECTIVES

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D curves in solving various engineering problems of all fields.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Understand and apply angle measurements, T-Ratios, and graph functions.
- Grasp the concepts of limits, differentiation and apply differentiation rules.
- Resolve proper and improper fractions into partial fractions with various factors.
- Solve problems using permutations and combinations and apply the binomial theorem.
- Understand complex numbers in different forms , perform arithmetic operations and applications of De Moivre's theorem.

COURSE CONTENT

UNIT - I: Trigonometry **(10 Periods)**

Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios ofmultiple angles, sub- multiple angles (2A, 3A, A/2). Graphs of | x | , sin x, cos x, tan x and e^x **.**

UNIT-II : Differential Calculus ***(14 Periods)***

Definition of function, concept of limits. Method to find the limits.

Differentiation of x^n*,* $\sin x$*,* $\cos x$*,* $\tan x$*,* e^x*,* $\log_e x$ *by definition. Differentiation of sum, product and quotientof functions. Differentiation of function of a function. Differentiation of trigonometric and inverse trigonometric functions, logarithmic differentiation, exponential functions.*

UNIT - III: Partial fractions: ***(10 Periods)***

Definition of polynomial fraction, proper & improper fractions and definitionof partial fractions. To resolve proper fraction and improper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors.

UNIT- IV : Permutations , Combinations and Binomial theorem ***(10 Periods)***

Value of ^nP_r *,* ^nC_r *and formula based problems.*

Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theoremfor any index (expansion without proof); applications of Binomial theorem.

UNIT-V : Complex Numbers: ***(12 Periods)***

Definition, real and imaginary parts of a complex number, polar and Cartesian representation of a complex number and its conversion from one form to other, conjugate of a complex number, modulus and amplitude of a complex number. Addition, subtraction, multiplication and division of complex numbers. De Moivre's theorem and its applications.

INSTRUCTIONAL STRATEGY

The basic instructional strategy to teach basic mathematics, binomial theorem, trigonometry, differential calculus etc. should be conceptual with real world applications of relevant branch. More numerical and theoryexamples can be used for clear understanding of the content.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Engineering Mathematics, 6/e., Vikas Publishing House.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House,New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1.	10	15
2.	14	25
3.	10	20
4	10	20
5	12	20
Total	**56**	**100**

APPLIED PHYSICS – I

L	*T*	*P*
3	1	2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc. .
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

COURSE CONTENTS

1. Units and Dimensions (8 Periods)

Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
Dimensions and dimensional formulae of physical quantities.
Principle of homogeneity of dimensions

Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities

Limitations of dimensional analysis

Error in measurement, accuracy and precision of instruments measuring instruments least count, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures and rounding off in calculation.

2. Force and Motion (10 periods)

Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.

Impulse and its Applications

Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.

Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)

Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist.

Gravitational force, Kepler's law of planetary motion.

Acceleration due to gravity and its variation with depth and height from earth surface.

3. Work, Power and Energy (8 periods)

Work: and its units, examples of zero work, positive work and negative work.

Friction: modern concept, types, laws of limiting friction, Coefficient of friction, reducing friction and its Engineering Applications.

Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation.

Mechanical Energy, Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

Power and its units, calculation of power in numerical problems

4 Rotational Motion (8 periods)

Concept of translatory and rotatory motions with examples

Definition of torque with examples

Angular momentum, Conservation of angular momentum (quantitative) and its examples

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 andsphere (hollow and solid) (Formulae only).

Rotational kinetic energy, Rolling of sphere on the slant plane

Comparison of linear motion and rotational motion.

5. Properties of Matter (12 periods)

Elasticity: definition of stress and strain, different types of modulii of elasticity, Hooke's law, significance of stress strain curve

Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure,Fortin's Barometer and its applications

Surface tension: concept, its units, angle of contact cohesive and adhesive forces, Capillary action ascent formula (No derivation), 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, application in hydraulic systems.

Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula) and their applications.

6. Heat and Thermometry (10 periods)

Concept of Heat and Temperature.

Modes of transfer of heat (Conduction, convection and radiation with examples)

Different scales of temperature and their relationship and definition of specific heat.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansionsand relation amongst them
Concept of Co-efficient of thermal conductivity and its engineering application.

Types of thermometers (Mercury Thermometer And Bimetallic Thermometer And TheirUses)

LIST OF PRACTICALS (To perform any Six Practicals)

1. To measure length, radius of a given cylindrical body like test tube, beaker using a one-year calipers and find volume of each object.
2. To determine diameter of a wire, a solid ball using a screw gauge.
3. To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
4. To verify parallelogram law of forces.
5. To find the coefficient of friction between wood and glass using a horizontal board.
6. To determine the atmospheric pressure at a place using Fortin's Barometer
7. To determine the viscosity of glycerin by Stoke's method
8. To verify law of conservation of mechanical energy (PE to KE).

9. To measure room temperature and temperature of hot bath using mercury thermometer and convert it into different scales.
10. To determine force constant of spring using Hooks law.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1 Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4 B.Sc.Practical Physics by C L Arora, S. Chand Publication..
5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6 Engineering Physics by DK Bhhatacharya& Poonam Tandan; Oxford University Press, New Delhi
7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8 V. Rajendran,physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10 Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	08	15
2	10	18
3	08	15
4	08	15
5	12	19
6	10	18
Total	**56**	**100**

APPLIED CHEMISTRY

L	*T*	*P*
3	1	2

COURSE OBJECTIVES:

There are numerous number materials are 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 analyses and properties of natural raw materials require for producing economical and eco-friendly finished products.

COURSE OUTCOMES

After undergoing this course, the students must be able to:

- Solve various engineering problems applying the basic knowledge of atomic structure andchemical 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.

COURSE CONTENT

Unit 1: Atomic Structure, Chemical Bonding and Solutions (11 periods)

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 uncertaintyprinciple, Quantum numbers – orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximummultiplicity Aufbau rule, electronic configuration.

Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example),
covalent bond (H_2, F_2, HF hybridization in $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond, in NH_4^+ and anomalous properties of NH_3, H_2O due to hydrogen bonding, andmetallic bonding.

Solution – idea of solute, solvent and solution, methods to express the concentration of solution molarity (M = mole per liter), Molality, Normality, ppm, mass percentage, volume percentage and mole fraction.

Unit 2: Water (11 periods)

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 andsimple numerical on water hardness.

Cause of poor lathering of soap in hard water, problems caused by the use of hard water inboiler (scale andsludge, foaming and priming, corrosion etc), and quantitative measurement of water

i). Water softening techniques – soda lime process, zeolite process and ion exchange process.

ii). Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

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

Unit 3: Engineering Materials (11 periods)

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (ma- trix), 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. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous withsuitable examples, properties and applications.

General chemical composition, composition based applications (elementary idea only

detailsomitted):Port land cement and hardening, Glasses Refractory and Composite materials.

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

Unit 4: Chemistry of Fuels and Lubricants (11 periods)

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

Proximate 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 andbiogas.

Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical proper- ties (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 (12 periods)

Electronic concept of oxidation, reduction and redox reactions.
Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws ofElectrolysis and simple numerical problems.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.

INSTRUCTIONAL STRATEGY

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 fractionof 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 propertiesof 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 hardnessof water.

Unit 3: Engineering Materials

Assignments: Preparation of table showing different ores of iron, copper and aluminiummetals alongwith their chemical compositions and classify in to oxide sulphide halide ores.

Seminar: Discuss the chemical reactions taking place in blast furnace in extractionof Fe, Cu and Al metals.

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

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 inthe 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 avail- able in market. Visit to sites such as Railway station to watch corrosion area in railways and research establishment in and around the institution.

LIST OF PRACTICALS:

Perform any Ten Laboratory Practicals.

Volumetric and Gravimetric analysis:

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of KMnO4 solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by KMnO4 solution.
4. Iodometric estimation of copper in the 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 0.01M sulphuric acid.
7. Proximate analysis of coal:
   a) Gravimetric estimation of moisture in given coal sample.
   b) Gravimetric estimation of 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 calorific value of solid or liquid fuel using bomb calorimeter.
11. Determination of viscosity of lubricating oil using Redwood viscometer.
12. Determination of flash and fire point of lubricating oil using Abel's flash point apparatus.
13. To verify the first law of electrolysis of copper sulfate using copper electrode.
14. Construction and measurement of emf of electrochemical cell (Daniel cell).
15. To study the effect of dissimilar metal combination.

(a) 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 www.chem1.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 (Fueland Combustion)
7 www.chemcollective.org (Metals, Alloys)
8 www.wqa.org(Water Treatment)

References/Suggested Learning Resources:

(b) 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. Dara, S. S. & Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, New Del-hi, 2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7. Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II,NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	11	20
2	11	20
3	11	20
4	11	20
5	12	20
Total	**56**	**100**

COMMUNICATION SKILLS IN ENGLISH

L	T	P
3	-	2

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.

COURSE OUTCOMES

After undergoing this course, the students must be able to:

1. Develop listening skills for enhancing communications.
2. Develop speaking skills with a focus on correct pronunciation and fluency.
3. 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 CONTENTS

Unit -1 Communication: Theory and Practice **(08 Periods)**

Basics of Communication, Definition Process of Communication
Types of communication (formal and informal, verbal and non-verbal), 7 C's of Communication
Barriers to communication and ways to overcome them
Tools or devices of Communication

Unit – 2 Soft Skills for Professional Excellence **(04 Periods)**

2.1 Introduction to Soft skills and hard skills
2.2 Importance of soft skills
2.3 Applying soft skills across cultures

Unit – 3 Reading Comprehension: English for Communication ***(08 Periods)***

On Communication
Professional Development of Technicians
Leadership and Supervision
The Romance of Reading
Sir C V Raman

Unit: 4 Professional Writing ***(14 Periods)***

CV Writing, Covering Letter, Resume, Notices, Precis -Writing, Official Letters (Memo, Circular, Office Orders, Agenda, Minutes of Meeting, Report Wring, E-mail Drafting)

Unit: 5 Vocabulary and Grammar ***(08 Periods)***

Sentence and its Types
Parts of Speech
Tenses
Active and Passive Voice

Punctuation
One Word Substitution, Idioms and Phrases

LIST OF PRACTICALS

Unit-1 Listening skills

1.1 Introduction to listening process and practice
1.2 Listening to recorded lectures/speeches/poems/interviews and Dialogues

Unit 2 Introduction to phonetics

2.1 Sounds: consonants, vowels (Monophthongs and Diphthongs)
2.2 Transcription of words (IPA) syllable diversion and word stress

Unit 3 Speaking skills

3.1 Self and Peer introduction
3.2 Extempore-Just a minute session
3.3 Greeting and starting conversation
3.4 Leave taking
3.5 Wishing well
3.6 Talking about likes and dislikes
3.7 Asking questions-polite responses
3.8 Apologizing/forgiving
3.9 Complaining/Warning
4.0 Asking and giving information
4.1 Getting and giving Permission
4.2 Asking for and giving Opinion
4.3 Delivering formal speeches
4.4 Mock Interviews
4.5 Presentation
4.6 Conversation practices in various situations such as -asking address, enquiries at places like retail shop, service center, bank, customer care etc.

Unit 4 Building Vocabulary

Word Formation
Phrasal Verbs, Foreign Phrases, Jargons
Word Games such as crosswords, scrabble, quiz spell it etc. (To enhance self-expression andvocabulary of participants.

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered activities in class roomand actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.
8. English for Communication (text Book Published by IRDT, Kanpur 1998).

Websites for Reference:

1. http://www.mindtools.com/ page 8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	20
2	4	10
3	8	20
4	14	30
5	8	20
Total	**42**	**100**

Engineering Graphics

L	*T*	*P*
-	-	4

COURSE OBJECTIVES

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, shouldbe to develop conceptual skills in the students following BISSP 46 – 1988.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Identify and use of different grades of pencils and other drafting instruments whichare used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawingsof objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles(orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise notvisible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches.
- Identify conventions for different engineering materials, symbols, sections of regularobjects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

COURSE CONTENT

Unit – I Basic elements of Drawing ***(05 Sheets)***

Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. Different types of lines as per BIS specifications Practice of vertical, horizontal and inclined lines,geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with thehelp of drawing instruments.
Common symbols and conventions of materials used in engineering.
Free hand and instrumental lettering (Alphabet and numerals) – Capital Letter, single stroke, vertical andinclined, series of 5,8,12 mm in the ratio of 7:4.

Dimensioning-

Necessity, method and principles, Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches Scales.
***Scales** –Needs & importance (theory), R.F., type of scales, and length of scale, drawing of plain and diagonalscales.*

Unit – II Orthographic projections (05 Sheets)

Introduction, Projection of Points in different quadrant, Projection of Straight Line- parallel to both planes, perpendicular and inclined to reference plane, Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only, Three views of orthographic projection of different objects. Identification of surfaces.

Unit – III Projection of Solid and Sections (05 Sheets)

Definition and types of Solids, To make projections, sources, Top view, Front view and Side view of varioustypes of Solid, Importance and salient features.
Drawing of full section, half section, partial or broken out sections, Off-set sections, revolved sections and removed sections, Convention sectional representation of various materials, conventional breaks for shafts,pipes, rectangular, square, angle, channel, rolled sections.

Unit – IV Isometric Projections (03 Sheets)
Introduction, Isometric scale and Natural scale, Isometric view and isometric projection, Illustrativeproblems related to objects containing lines, circles and arcs shape only.
Conversion of orthographic views into isometric view /projection.

Unit-V Introduction to Auto CAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.
Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.

INSTRUCTIONAL STRATEGY

Teacher should show model of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings.

Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs forpractice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

ENGINEERING WORKSHOP PRACTICE

L	*T*	*P*
-	-	4

COURSE OBJECTIVES

The course aims to provide hands-on experience and practical skills in various essential workshops, including carpentry, fitting, welding, sheet metal, plumbing, and painting and polishing. Students will gain proficiency in using different tools and machines, understanding and executing various processes and operations, and completing multiple jobs that involve intricate tasks. This practical knowledge will equip students with the necessary skills to handle real-world tasks efficiently, fostering a deeper understanding of the techniques andsafety measures required in each shop.

COURSE OUTCOMES

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

1. Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking, and cutting tools & equipment's and machines
2. Explain job drawing and complete jobs as per specifications in allotted time
3. Inspect the job for the desired dimensions and shape
4. Operate, control different machines and equipment's adopting safety practices

DETAILS OF PRACTICAL CONTENTS

1. CARPENTRY SHOP

Demonstration of different wood working tools / machines.

Demonstration of different wood working processes, like plaining, marking, chiselling, grooving, turning of wood etc.

Three jobs involving joint like mortise and tenon, dovetail, bridle, and half lap.

2. FITTING SHOP

Demonstration of different fitting tools and drilling machines and power tools

Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.

Three fitting job involving practice of cutting, chipping, filing, marking, hacksawing, drilling, tapping, etc.

3. WELDING SHOP

Demonstration of different welding tools/machines.

Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.

Two simple job involving butt and lap joint and T. Joint using electric arc welding.

4. SHEET METAL SHOP

Demonstration of different sheet metal tools/machines.

Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.

Three simple job involving sheet metal operations, soldering, and riveting.

Jobs

Cutting Practices

Single / Double Seam Joint

Cylinders

5. PLUMBING SHOP

Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).

Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).

5.3 One simple job involving pipe cutting and external thread cutting on GI pipe.

6. PAINTING AND POLISHING SHOP

Introduction of paints, Varnishes, Reason for Surface preparation, Advantage of painting, other method of surface coating i.e. Electroplating etc.

Jobs

To prepare a wooden surface for painting apply primer on side and to paint in the same side.

To prepare metal surface for painting, apply primer and paint on same side.

To Prepare a metal surface for spray painting. First spray primer and paint the same by spray gun and compressor system.

REFERENCES:

1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
2. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
3. J.P. Bhati, Engineering Workshop, C.B.H. Publication, Jaipur.
4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
6. Roop Lal and Bharadwaj P. K., Prarambhik KaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi

1.7 SPORTS AND YOGA

L T P

- - 2

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 stimulatingtheir 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 anda means to better health.

COURSE OUTCOMES:

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

- Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, andrelaxation.
- Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- Learn breathing exercises and healthy fitness activities
- Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- Perform yoga movements in various combination and forms.
- Assess current personal fitness levels.
- Identify opportunities for participation in yoga and sports activities.
- Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
- Improve personal fitness through participation in sports and yogic activities.
- Develop understanding of psychological problems associated with the age and lifestyle.
- Demonstrate an understanding of sound nutritional practices as related to health andphysical performance.
- Assess yoga activities in terms of fitness value.
- Identify and apply injury prevention principles related to yoga and physical fitness activities.
- Understand and correctly apply biomechanical and physiological principles elated to exercise and training

COURSE CONTENT

1 Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education

2 Yoga

- Meaning & Importance of Yoga
- Elements of Yoga- Gyan Yoga, Bhakti Yoga, Karm Yoga, Hathyoga, Astang Yoga .
- Introduction - Asans, Pranayama, Meditation & Bandh , Mudra and shat Karm .

- Meaning of Practice of various Yogic Sukhasan, Vyayams
- Practice of Asans and Benefits – Sidhasana, Padmasana,Vajrasana, Shasakasan, Singhasan, Gomukhasan, Virasan, Dhanurasan, Matsnyendrasan, Gorakhasan, Paschimottansan, Mayurasan, Garunasan, Pawanmuktasan, Kurmasan, Mandukasan, Shalabhasan, Makrasan, Bhujangasan, Naukasan, Shavasan, Sharvangasans, Halasan.
- Practice and Benefits of Pranayamas – Anulom- Vilom, Surya Bhedhi, Ujjayi, Sheetkari, Bhastrika, Bharamri, Murchha, kewali etc .
- Practice of Meditation – Meaning of Meditation, Types , Techniques, Benefits .

3 Olympic Movement

- 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.)

4 Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness & Wellness
- Components of Physical fitness
- Concept of Positive Lifestyle

5 Yoga & Lifestyle

- Ideal life style
- Asans and pranayams a preventive measures
- Yoga and Immunity
- Concept of Yogic diet.
- **Life Style Diseases-** Yoga management of Diseases, Yoga management of Stress, Yoga management of Obesity, Yoga management of High Blood Pressure, Yoga management of Insomia, Yoga management of Asthma, Yoga management of Joints Pains, Yoga management of Digestive Disorders .

6 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,

7 Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.

8 Training and Planning in Sports

- Meaning of Training
- Warming up and limbering down

9 Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development

10 Doping

- Meaning and Concept of Doping

11 Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.

12 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.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.

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)

MATHEMATICS - II

L	*T*	*P*
3	1	-

COURSE OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, integral calculus, coordinate geometry, basic elements of vector algebra and first order differential equations.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Solve linear equations using determinants and matrix algebra.
- Perform integration techniques, solve area and volume problems.
- Solve first order differential equations and apply numerical methods.
- Form and interpret equations of lines, circles and conics.
- Perform vector operations and solve related engineering problems of relevant branch.

COURSE CONTENTS

UNIT - I: Determinants and Matrices (10 periods)

Elementary properties of determinants upto 3rd order, consistency of equations, Crammer's rule. Algebra of matrices, inverse of a matrix, matrix inverse method to solve a system of linear equations in three variables.

UNIT - II: Integral Calculus (12 periods)

Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions (for linear factors only). Introduction to definite integration. Use of formulae - $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$, $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\,dx$ *for solving problems ,where m and n are positive integers.*

Applications of integration for (i). Simple problems on evaluation of area bounded by a curve and axes.(ii). calculation of volume of a solid formed by revolution of an area about axes. (Simple problems).

UNIT-III: Differential Equations & Numerical Methods (15 periods)

Definition of differential Equations, order and degree of a differential equation, formation of differential equations, solution of first order and first degree differential equations by variable separable method (simple problems). Trapezoidal rule, Simpson's 1/3 and Simpson's 3/8 rule and their applications in simplecases. MATLAB – Simple Introduction.

UNIT - IV: Two dimensional Co-Ordinate Geometry ***(10 periods)***

Equation of straight line in various standard forms (without proof), intersection of two straightlines,angle between two lines. Parallel and perpendicular lines, perpendicular distance formula.

General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius,

ii. Three points lying on it and

iii. Co-ordinates of end points of a diameter;

Definition of conics (Parabola, Ellipse, Hyperbola), their standard equations without proof. Problemson conics when their foci, directories or vertices are given.

UNIT - V: Vector Algebra ***(9 periods)***

Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector product of two vectors. Simple problems related to work, moment and angular velocity.

INSTRUCTIONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. Differential equations and applications of differential equations can be taught with engineeringapplications of relevant branch.

MEANS OF ASSESSMENT

– Assignments and Quiz/Class Tests
– Mid-term and End-term Written Tests
– Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
4. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1.	10	20
2.	12	20
3.	15	25
4	10	20
5	9	15
Total	**56**	**100**

APPLIED PHYSICS – II

L	*T*	*P*
3	1	2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles.In all contents, SI units should be followed.

COURSE OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and its measurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- Explain Bio-Savart Law, Ampere’s law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor
- Apply the knowledge of diodes in rectifiers, adapters IC’s and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fiber and its uses in Medical field and Communication.

COURSE CONTENTS

1. Wave motion and its applications (8 periods)

Wave motion, transverse and longitudinal wave motion with examples. Sound and light waves and their properties. Definition of wave velocity, frequency and wave length and their relationship.

Wave equation y = r sin wt, phase, phase difference, principle of superposition of waves and amplitude

Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., study of vibration of cantilever and determination of its time period, concept of simple harmonic progressive wave.

Free, Damped and forced oscillations, Resonance with examples.

Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building.

Ultrasonic – Introduction properties and applications in engineering and medical applications.

2 Electrostatics (8 periods)

Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.

Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

Capacitor and its working principle, Types of capacitors.Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numerical).

Dielectric and its effect on capacitance, dielectric break down.

4. Current Electricity (8 periods)

Electric Current and its unit, direct and alternating current Resistance and its units,

Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance of a wire, Colour coding of carbon Resistances, Ohm's law.

Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge)

Concept of terminal potential difference and Electromotive force (EMF).

Heating effect of current, Electric power, Electric energy and its units (related numerical problems),Advantages of Electric Energy over other forms of energy

5. Electromagnetism (8 periods)

Types of magnetic materials. Dia, para and ferromagnetic materials with their properties.

Magnetic field and it units, magnetic intensity, magnetic lines of force, magnetic flux and its units,magnetization.

Concept of electromagnetic induction, Faraday's Laws, Lorentz force (Force on moving charge in magnetic field). Force on current carrying conductor.

6. Semiconductor physics (8 periods)

Energy bands in solids (Definition only)Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction and P N junction diode and its V-I characteristics

Diode as rectifier – half wave and full wave rectifier (center taped),

Semiconductor transistor, PNP and NPN (concepts only) and some electronic application (list only)

Application of semiconductor diodes (Zener, LED).

7. Modern Physics (8 Periods)

Lasers: Energy levels, ionization and excitation potential, spontaneous and stimulated emission, population inversion, pumping methods.

Types of lasers: Ruby, He- Ne lasers, Laser characteristic, Engineering and medical applications of lasers.

Fiber optics- introduction to optical fibers, light propagation, acceptance angle and numerical aperture, fiber types, application in telecommunication, medical and sensors.

Nano Science and Nano technology: Introduction, nano particles and nano materials, properties at Nano scale, Nano technology, nano technology based devices and applications.

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To determine the time period of a cantilever.
3. To verify the laws of reflection from a plane mirror / interface.
4. To verify the laws of refraction (Snell's law) using a glass slab.
5. To determine the focal length and magnifying power of a convex lens.
6. To verify laws of resistances in series and parallel combination.
7. To verify ohm's laws by drawing a graph between voltage and current.
8. To measure very low resistance and very high resistances using Slide Wire bridge
9. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
10. To draw characteristics of a PN junction diode and determine knee and break down voltages.
11. To verify the Kirchhoff's Law using electric circuit.
12. To find numerical aperture of an optical fiber.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Mid-Term and End-Term written test
–Model Making
–Actual Lab & Practical Work
–Viva-Voice

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	8	15
2	8	15
3	8	15
4	8	15
5	8	15
6	8	15
7	8	10
Total	**56**	**100**

INTRODUCTION TO IT SYSTEMS

L	T	P
2	-	4

COURSE OBJECTIVES

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools (Google suits)

COURSE CONTENTS

1. Introduction to Computers and Peripherals. (05 Periods)

Introduction, Computer Generations, Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, Keyboard, Mouse, display devices, Printer, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

1. Operating System and Application Software (06 Periods)

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, Working with windows OS, Desktop components, Menu bars, creating shortcut of program. Installation of Application software's, Antivirus and Drivers.

2. Office Tools: MS Office/Open Office/ Libre Office (06 Periods)

Creation of document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc, google presentation)

3. Internet (06 Periods)

Network topologies, Basics of Networking,– LAN,MAN, WAN, Connecting Devices(Bridge, Switch, Router, Gateway),Wi-Fi technologies, Concept of IP Address, DNS, Search Engines, e- mail, Web Browsing.

4. Basics of Information Security (05 Periods)

Introduction to security, Security threats: detection and prevention, Indian Cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of operating system. (windows/linux/others)
3. Installation of various application software and peripheral drivers.
4. Creation and Management of files and folders (Rename, delete, search)
5. Installation of Antivirus and remove virus.
6. Scanning and printing documents.
7. Browsing, Downloading, Information using Internet.
8. E-Mail ID creation, composing, sending and receiving e-mail. Attaching a file with e- mail message.

9. Word Processing (MS Office/Open Office) File Management, Editing documents, Mail Merge, Security etc.
10. Spread Sheet Processing (MS Office/Open Office/Libre Office)Addition, deletion, formulation,Securityetc.
11. PowerPoint Presentation (MS Office/Open Office/Libre Office)Preparing Slides, customization, animation, Security etc.
12. Google Suite.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

MEANS OF ASSESSMENT

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net…Set…Go… Surviving in an e-world by AnushkaWirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Reference websites

1. www. tutorialspoint..com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org

5. Swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	18
2	6	21
3	6	22
4	6	21
5	5	18
Total	**28**	**100**

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P

3 1 2

COURSE OBJECTIVES

To learn basic concepts of various active and passive electronic components, signals, measuring instruments, digital electronics, electric and magnetic circuits, ac circuits, transformer, motors and their applications. To help the students deal with the electrical and electronics engineering principles and applications in industrial processes of different fields.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Understand and identify key electronic components and their applications.
- Use and understand basic electrical measuring instruments.
- Grasp the fundamentals of logic gates, Boolean algebra, and digital circuits.
- Understand basic concepts of electric and magnetic circuits.
- Analyze A.C. circuits and understand phase relationships and power calculations.
- Understand the principles and applications of transformers and electrical machines.
-

COURSE CONTENTS

UNIT- I Overview of electronic components: (12 Periods)

Active and Passive components, Resistor, Capacitor, Inductor and their types. Introduction to semi- conductor, Intrinsic and Extrinsic semi-conductors, P-N Junction diode - forward and reverse bias, V-I characteristics, Zener diode, LED. Bipolar Junction Transistor - PNP and NPN Transistor and their characteristics. Basics of FET, MOSFET.

UNIT- II Basic measuring instruments**: **(06 Periods)

Basic concept of Ideal and non-ideal voltage and current sources, sinusoidal and non sinusoidal waveforms, ammeter, voltmeter, wattmeter and digital multimeter, CRO (Block diagram, working and its uses).

UNIT –III Overview of Digital Electronics**:* ***(10 Periods)

Analog and digital signal, advantages of digital system. Introduction to Logic levels and Boolean Algebra, Basics of number system, Logic Gates-Truth Table and Symbol of AND, OR, NOT, NAND, NOR, ExOR, ExNOR Gates. Introduction to Latch, Flip Flops, Combinational Circuit and Sequential Circuit.

Unit -IV Electric and Magnetic Circuits: ***(8 Periods)***

Definitions of basic terms, such as Current, Resistance, EMF, Potential Difference, Power and Energy,Ohm's Law and its limitation, Kirchhoff's laws; M.M.F, magnetic force, flux, permeability, hysteresisloop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws ofelectromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations ofself and mutual inductance; Analogy between electric and magnetic circuits.

Unit -V A.C. Circuits: ***(10 Periods)***

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R- L-C series circuits; Power in A. C. Circuits, power triangle; Relationship between line and phase voltage and line and phase current in Star and Delta connections.

Unit -VI Transformers and Machines: ***(10 Periods)***

Single phase transformer: Construction, working principle, types, EMF equation, transformation ratio oftransformers. Brief idea of Auto transformer.

Machines: DC machines: Types, EMF equation of generator and motor.

Single Phase Induction Motor: Principle of operation and introduction to methods of starting.Three Phase Induction Motor: Construction and Principle of operation.

INSTRUCTIONAL STRATEGY

The instructional strategy combines lectures, demonstrations, and hands-on labs. Lectures will cover key concepts, while demonstrations will illustrate component functions and instrument operations. Hands- on labs will provide practical experience with electronic components and measuring instruments. Interactive quizzes and problem-solving sessions will reinforce and assess understanding, ensuring practical application of theoretical knowledge.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Lab & Practical Work
–Viva-Voice

List of Practicals

1. Identify various passive and active electronic components in the given circuit.
2. Determine the value of given resistor using digital multi-meter to confirm with color code.
3. Exercise of soldering and de-soldering of components in circuits.
4. To study performance of PN-junction diodes and draw its V-I characteristics.
5. To measure frequency, time period and amplitude of a sinusoidal signal using CRO.
6. To measure voltage and current using digital multi-meter.
7. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR, XNOR.
8. Implement and realize Boolean Expressions with Logic Gates
9. Verify the Kirchhoff's laws.
10. Measure voltage, current and power in 1-phase circuit with resistive load.
11. Measure voltage, current and power in R-L series circuit.
12. Verify the ohms law.
13. Use of voltmeter, ammeter, and watt-meter.
14. Connect resistors in series and parallel combination on bread board and measure its value using digital multi-meter.
15. Connect capacitors in series and parallel combination on bread board and measure its value using multi-meter.

REFERENCE BOOKS –

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition, ISBN: 9781107464353.
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405.
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN: 97881236529513.
7. Sedha, R.S., A Textbook of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833.
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978.

9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13: 9788121924504.
10. Bell, David, Fundamentals of Electronic Devices and Circuits, Oxford University Press, New Delhi, 2015, ISBN: 9780195425239.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	13	20
2	05	10
3	10	15
4	8	15
5	10	20
6	10	20
Total	**56**	**100**

ENGINEERING MECHANICS

L T P
3 1 2

COURSE OBJECTIVES

The course provides a foundational understanding of mechanics, covering force systems, equilibrium, and beam analysis under different loads. It explores friction and its applications, centroids and moments of inertia for various shapes, and the principles and applications of simple lifting machines.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Identify the force systems for given conditions by applying the basics of mechanics.
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems.
5. Select the relevant simple lifting machine(s) for given purposes.

COURSE CONTENTS

Unit – I Basics of Mechanics and Force System : (12 Periods)

Significance and relevance of mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium : (11 Periods)

Equilibrium and Equilibrant, Free body and free body diagram, Analytical and graphical methods of analysing equilibrium. Lami's Theorem – statement and explanation, Application for various engineering problems.

Beam- Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.

Unit– III Friction : (11 Periods)

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Unit– IV Centroid and Moment of Inertia : (11 Periods)

Concept, definition and determination of Centroid of plain figures (square, rectangle, triangle, circle, semi-circle, quarter circle) and Centre of gravity of symmetrical solid bodies (Cube, cuboid, cone, cylinder, sphere, hemisphere).

Concept of moment of inertia, Radius of Gyration, Theorem of perpendicular and parallel axis theorem. Concept of Second moment of area of standard areas (Rectangle, Triangle and circle) and composite area (L,T,I section).

Unit – V Simple Lifting Machine : *(11 Periods)*

Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio,efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanicaladvantage and efficiency, reversible and non-reversible machines, conditions for reversibility.

System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application [Simple problems on the above topics]

List of practical to be performed:

1. To study various equipment related to Engineering Mechanics.
2. To find the M.A.,V.R., Efficiency and law of machine for differential Axel and Wheel.
3. To find the M.A.,V.R., Efficiency and law of machine for Simple Screw Jack.
4. Derive Law of machine using Worm and worm wheel.
5. Determine resultant of concurrent force system applying law of Polygon of forces using force table.
6. Determine resultant of concurrent force system graphically.

7. Determine resultant of parallel force system graphically.
8. Verify Lami's theorem.
9. Study forces in various members of Jib crane.
10. Determine force reaction's for simply supported beam.
11. Determine Coefficient of friction for motion on horizontal and inclined plane.
12. Determine centroid of geometrical plane figures.

INSTRUCTIONAL STRATEGY

The instructional strategy includes lectures, visual aids, and interactive examples for key mechanics concepts and force systems, along with problem-solving sessions. Equilibrium concepts are taught with practical demonstrations and hands-on beam analysis. Friction is explored through case studies and practical demonstrations, followed by exercises. Centroid and moment of inertia are covered with visual aids and practical tasks. Simple lifting machines are introduced through lectures and demonstrations, with problem-solving on mechanical advantage and efficiency.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Lab & Practical Work
–Viva-Voice

RECOMMENDED BOOKS :

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.
8. Bhavikatti S.S., Engineering Mechanics, New Age International Publishers

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	12	20
2	11	20
3	11	20
4	11	20
5	11	20
Total	**56**	**100**

ENVIRONMENTAL SCIENCE

L	T	P
3	-	-

COURSE OBJECTIVES:

A diploma holder must have knowledge of different types of pollution caused due to industriesand constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. He should know the concept of hazards and disaster management.

COURSE OUTCOMES:

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable development.
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Explain environmental legislation acts.
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Analyze the impact of human activities on the environment
- Understand the basic concept of disaster and hazards.
- Analyze the impact of disaster on various social components.

COURSE CONTENT

1. Introduction (06 Periods)

Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non- renewable. Global Warming, Climate change and its impact ,Green House Effect, Acid Rain, Conceptof Green Building, Ground water management.

2. Air Pollution and Noise pollution (08 Periods)

Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air Pollution Control Methods. Introduction to Air Pollution and its Prevention and Control Act 1981 & Environmental Protection Act 1986 and Function of State pollution control board and National GreenTribunal (NGT).
Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

3. Water Pollution and Soil Pollution (11 Periods)

Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollutionon human health, Turbidity, pH, total suspended solids, total dissolved solids, Concept of dissolved O_2, BOD, COD. Prevention of water pollution. Introduction to Water (Prevention and Control of Pollution) Act 1974.Concept of rain water harvesting system.
Sources of soil pollution, Types of Solid waste- House hold, Hospital, From Agriculture,

Biomedical, Animal waste and human waste, sediments and E-waste, Plastic Waste .Effect of Solid waste, Disposal of Solid Waste- Solid Waste Management.

4. Disaster Causes and Hazards (6 Periods)

Introduction
Classification of Natural Disasters
Classification of Natural Disasters in India

- Earthquake
- Tsunami
- Flood
- Drought
- Land Slide
- Thunderstorm and Lightening

5 Disaster Management (11 Periods)

Framework

- Yokohama Strategy for a Safer World (1999)
- The Hyogo Framework for Action (HFA) (2005-2015)
- Sendai Framework for Action (SDGS) (2015-2030)

Disaster Management, Preparedness and Response in India

- National Disaster Management Authority (NDMA) Guidelines
- National Policy on Disaster Management (2009)
- National Disaster Management Act (2005)
- NDRF (National Disaster Response Force), SDRF (State Disaster Response Force), DDRF (District Disaster Response Force), and Aapda Mitra.
- Case studies of disaster management efforts: COVID-19 Pandemic, Earthquakes, Firefighting, Thunder Storm, and Lightning.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS –

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.

2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and DeepPublications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; DhanpatRai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons,New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR,Chandigarh.
9. Disaster Management Second Edition AICTE Recommended by S C Sharma, Khanna Publishers
10. Bharat Bhautik Paryavaran Class 11, By NCERT.
11. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna publishing House, New Delhi

Websites for Reference:

- http://swayam.gov.in
- https://www.amazon.in/Prabhandhan
- https://ncert.nic.in/textbook.php?khgy1=0-6
- https://rb.gy/yergl

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	15
2	8	20
3	11	25
4	6	15
5	11	25
Total	**42**	**100**

Program Outcome (POs) – Diploma

1. **PO 1: Engineering knowledge:** An ability to apply knowledge of mathematics, science, and engineering practices.
2. **PO 2: Problem analysis**: An ability to identify and solves engineering problems.
3. **PO 3: Design/development of solutions:** An ability to design a component, or process to meet desired needs within realistic constraints.
4. **PO 4: Conduct investigations of complex problems:** An ability to use the skills, and modern engineering tools necessary for solving engineering problems.
5. **PO 5: Modern tool usage:** The broad education and understanding of new engineering techniques necessary to solve engineering problems.
6. **PO 6: The engineer and society:** Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.
7. **PO 7: Environment and sustainability:** Articulate a comprehensive world view that integrates diverse approaches to sustainability.
8. **PO 8: Ethics:** Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
9. **PO 9: Individual and team work:** An ability to analyses the local and global impact of computing on individuals, organizations, and society.
10. **PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **PO 11: Project management and finance:** Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.
12. **PO 12: Life-long learning:** A recognition of the need for, and an ability to engage in life-long learning.

APPLIED MATHEMATICS-III

L T P

3 1 0

COURSE OBJECTIVES

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

LEARNING OUTCOMES

After understand this course, the students will be able to:

- Understand matrix operations and uses of matrix in different problems.
- Apply elementary row and column operations in finding inverse of a matrix.
- Find Eigen values, Eigen vectors of matrix and their different properties.
- Understand degree/order of differential equations and their solution techniques.
- Use differential equations in engineering problems of different areas.
- Find Fourier series expansion of a function.
- Apply Laplace transform and their applications in solving engineering problems.
- Understand concept of probability distribution and their applications.

DETAILED CONTENTS

UNIT-1, MATRICES	PERIODS
Algebra of Matrices:- Addition, Multiplication of Matrices, Null Matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix. Definition and Computation of inverse of a matrix. Elementary Row/Column Transformation: - Meaning and use in computing inverse and rank of a matrix. **Linear Dependence: -** Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.	**10**
UNIT-2, Differential Calculus	**PERIODS**
Function of two variables, identification of surfaces in space, conicoids. **Partial Differentiation:-** Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians. **Vector Calculus: -** Vector function, Introduction to double and triple differential and integration of vector functions, gradient, divergence and curl, differential derivatives.	**08**
UNIT-3, Differential Equation	**PERIODS**
Formation, Order, Types, Solution: - Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of differential equation, Linear, nonlinear equation.	**08**
UNIT-4, Integral Calculus	**PERIODS**
Beta and Gamma Functions: - Definition, Use, Relation between the two, their use in evaluating integrals. **Fourier Series: -** Fourier series of f(x),-n<x<n, Odd and even function, Half range series.	**08**

Laplace Transform:-Definition, Basic theorem and properties, Unit step and Periodic functions, inverse Laplace Transform, Solution of ordinary differential equations	
UNIT-5, Probability and Statistics	**PERIODS**
Probability: - Introduction, Addition and Multiplication theorem and simple problem.	**06**

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-III by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-II by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

COMMUNICATION SKILLS – II

L T P

3 0 0

COURSE OBJECTIVES

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized set up and social context.

DETAILED CONTENTS

UNIT-1, Functional Grammar	**PERIODS**
1.1 Prepositions 1.2 Framing Questions 1.3 Conjunctions 1.4 Tenses	**8**
UNIT-2, Reading	**PERIODS**
2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the Passage should be covered under this topic.	**8**
UNIT-3, Writing Skill	**PERIODS**
3.1 Correspondence Business Letters- Floating Quotations, Placing Orders, Complaint Letters.	**8**
UNIT-4, Official Letters Writing Skill	**PERIODS**
4.1 Official Letters Letters to Government and other Offices Memos, Circular, Office Orders	**8**
UNIT-5, Report Writing	**PERIODS**
5.1 Agenda & Minutes of Meeting Report Writing	**8**

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project-oriented manner were the learning happens as a byproduct.

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.

2 Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.

3 High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.

4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

FSEC301	AI FOR EVERYONE	L T P 2 0 0	2 credits

Course Objectives:

CO1	**Introduce** fundamental concepts of Artificial Intelligence (AI) and its real-world applications.
CO2	**Familiarize** students with basic AI techniques such as machine learning, natural language processing, and computer vision.
CO3	**Enhance** understanding of ethical considerations and societal impacts of AI.
CO4	**Develop** problem-solving skills using AI tools and frameworks.
CO5	**Encourage** critical thinking about the future of AI in various domains such as healthcare, education, business, and security.

Unit-I

Introduction to AI (Concept + Hands-on): What is AI? Understanding AI vs. Machine Learning vs. Deep Learning, AI in daily life: Smart assistants, AI in social media, AI in e-commerce, Prompt Engineering, Real Life Applications of AI. Tools: Explore AI-based tools (Google AI, ChatGPT , MetaAI,Gemini).

Unit-II

Introduction to Machine Learning and Deep Learning: Introduction to learning theory, Methods and Models.Supervised vs. Unsupervised Learning (Examples from real life), Reinforcement Learning, Introduction to ANN and Deep Learning.

.

Unit-III

Computer Vision & Image Processing: Introduction to Image processing and Computer Vision ?, Hardware used, Face Recognition, Object Detection, and AI-powered Cameras, How AI understands text & speech, AI in Chatbots, Sentiment Analysis, and AI-based Translation Practical

Unit-IV

AI in Automation & Robotics: AI-powered automation in businesses, How AI is used in robotics and smart homes, Ethical AI & Responsible AI, Bias in AI and fairness in decision-making, How to use AI responsibly.

Unit-V

Mini AI Projects (Without Coding): Hands-on Project Options: AI for Image Classification: Train an AI model to recognize objects Create an AI Chatbot: Use Dialog flow or Chatbot.com AI in Business: Automate tasks using AI-based productivity tools.

* **Students will present their AI Project (Simple AI-based tool using existing platforms) Complete an AI-based quiz & get a certification.**

Text books and References:

1. **Stuart Russell & Peter Norvig** – *Artificial Intelligence: A Modern Approach* (Pearson, 4th Edition)
2. **John Paul Mueller & Luca Massaron** – *Artificial Intelligence For Dummies* (Wiley)"A beginner-friendly guide to AI concepts, applications, and future trends."
3. **Thomas H. Davenport & Nitin Mittal** – *All in on AI: How Smart Companies Win Big with Artificial Intelligence* (Harvard Business Review Press), Explains AI strategies in business and industry.

COURSE OUTCOMES:

CO1	**Understand** the fundamental principles and applications of AI in different industries.
CO2	**Explain** key AI techniques, including supervised and unsupervised learning, deep learning, and neural networks.
CO3	**Analyze** ethical challenges and biases in AI systems and their impact on society.
CO4	**Apply** AI-driven solutions in fields like healthcare, finance, and automation.
CO5	**Critically evaluate** the benefits and risks associated with AI technologies.

ELECTRICAL INSTRUMENTATION AND MEASUREMENT

L T P

3 1 1

COURSE OBJECTIVES

Diploma holders in Electrical Engineering have to work on various jobs in the field as well as in testing laboratories and on control panels, where he performs the duties of installation, operation, maintenance and testing by measuring instruments. Persons working on control panels in power plants, substations and in industries will come across the use of various types of instruments and have to take measurements. Instruments used to read and observe the general electrical quantities like current, voltage, power, energy, frequency, resistance etc and their wave shapes, have been incorporated in this subject. So the technician will know the construction and use of various types of electrical instruments.

COURSE OUTCOMES

After undergoing the subject, student will be able to:

- Connect and repair different indicating and recording instruments in electric circuits
- Measure different electrical quantities like current, voltage, power, energy, power
- factor, frequency etc.
- Select the type and range of instruments to be used for the job
- Operate CT (Current Transformer) and PT (Potential Transformer) for measurement
- Select and use suitable sensors for measurements of different non-electrical quantities
- Use instruments for measuring different electrical quantities
- Use sensors for measuring non electrical quantities
- Operate on smart metering system in industry

DETAILED CONTENTS

UNIT 1- Introduction to Electrical Measuring Instruments	**Periods**
Concept of measurement and instruments, Concept of measurement of electrical quantities and instruments for their measurements, sources of error. Types of electrical measuring instruments – indicating, integrating, and recording type instruments, Essentials of indicating instruments – deflecting, controlling, and damping torque.	**6**
UNIT 2- Ammeters and Voltmeters (Moving coil and moving iron type)	**Periods**
Concept of ammeter and voltmeters and difference between them, Construction and working principles of moving Iron and moving coil instruments, Merits and demerits, sources of error and application of these instruments.	**5**
UNIT 3- Wattmeter's (Dynamometer Type) & Energy Meter	**Periods**
Construction, working principle, merits and demerits of dynamometer type wattmeter, Digital wattmeter's. Induction Type: Construction, working principle, merits and demerits of single-phase and three-phase energy meters, Errors and their compensation, Simple numerical problems, Construction and working principle of maximum demand indicators, Digital energy meter (diagram, construction and application)	**8**
UNIT 4- Miscellaneous Measuring Instruments	**Periods**
Construction, working principle and application of Meggar, Earth tester(analog and digital) Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter) 5.2 Instrument Transformers: Construction, working and applications	**6**

a) CT b) PT	
UNIT 5- Electronic Instruments and LCR meters	**Periods**
Cathode Ray Oscilloscope: Block diagram, working principle of CRO and its various controls. Applications of CRO. Digital multi-meter (only block diagram) and Applications. Study of LCR meters and their applications.	**15**
Part-I Transducers & Power Measurements in 3-phase circuits by	
Introduction, Types of Transducers (1 phase,3 phase). Basic concept of pressure measurement, flow measurement, level measurement, displacement measurement using transducers, Two wattmeter method in balanced and unbalanced circuits and simple problems & Three wattmeter method.	
Part-II - Measurement of Temperature & Smart Metering System	
Different types of thermometers, thermocouple, resistance temperature detector and their construction, principle and working. Thermal Imager Camera (Concept), AMI (Advance Metering Infrastructure), Functions of AMI, cyber-Security, Advantages Smart Meter Technology: AMR (Automatic Metering Reading), inverse/reverse metering system in solar power plant, MRI (Meter Reading Instrument).	

LIST OF PRACTICALS

1. Use of analog and digital multimeter for measurement of voltage, current (A.C/D.C) and resistance
2. Measurement of pressure by using LVDT
3. To measure the value of earth resistance using earth tester.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power
5. factor meter and to verify results with calculations.

References

1. Electrical Measurements and Measuring Instruments by Golding and Widdis; Wheeler Publishing House, New Delhi
2. Electrical Measurements and Measuring Instruments by SK Sahdev, Uneek International Publications, Jalandhar
3. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi.
4. Electric Instruments by D. Cooper
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi.

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

ELECTRICAL MACHINES – I

L T P

3 1 1

COURSE OBJECTIVES

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- Operate and maintain D.C. Generator
- Operate and maintain D.C. shunt, series and compound motors
- Execute speed control on D.C. Motors
- Select which type of D.C. motor suits a particular job
- Connect and use single phase transformer
- Operate auto transformers
- Conduct open CKT and short CKT tests on a single phase transformer
- Test polarity of windings of a three phase transformer and connect windings in various configurations
- Operate and maintain three phase transformers

DETAILED CONTENTS

UNIT-1, Introduction to Electrical Machines	PERIODS
1.1 Definition of motor and generator 1.2 Torque development due to alignment of two fields and the concept of torque angle 1.3 Electro-magnetically induced emf 1.4 Elementary concept of an electrical machine 1.5 Comparison of generator and motor 1.6 Generalized theory of electrical machines	**20**
UNIT-2, DC Machines	**PERIODS**
2.1 Main constructional features, Types of armature winding 2.2 Function of the commutator for motoring and generation action 2.3 Factors determining induced emf 2.4 Factors determining the electromagnetic torque 2.5 Various types of DC generators 2.6 Significance of back e.m.f., the relation between back emf and Terminal voltage	**25**

2.7 Armature Reaction 2.8 Methods to improve commutation 2.9 Performance and characteristics of different types of DC motors 2.10 Speed control of dc shunt/series motors 2.11 Need of starter, three point dc shunt motor starter and 4 point starter 2.12 Electric Braking 2.13 Applications of DC motors 2.14 Faults in dc machines and their retrospective 2.15 Losses in a DC machine 2.16 Determination of losses by Swinburne's test 2.17 Rating and Specifications of DC machines	
UNIT-3, Single Phase Transformer	**PERIODS**
3.1 Introduction 3.2 Constructional features of a transformer and parts of transformer 3.3 Working principle of a transformer 3.4 EMF equation 3.5 Transformer on no-load and its phasor diagram 3.6 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram 3.7 Mutual and leakage fluxes, leakage reactance 3.8 Transformer on load, voltage drops and its phasor diagram 3.9 Equivalent circuit diagram 3.10 Relation between induced emf and terminal voltage, voltage regulation of a transformer- mathematical relation 3.11 Losses in a transformer 3.12 Open circuit and short circuit test. Calculation of efficiency, condition for maximum efficiency-maintenance of Transformer, scheduled Maintenance 3.13 Auto transformer construction, working and applications 3.14 Different types of transformers including dry type transformer. 3.15 Rating and Specifications of single phase transformer	**25**
UNIT-4, Three Phase Transformer	**PERIODS**
4.1 Construction of three phase transformers and accessories of transformers such as Conservator, breather, Buchholtz Relay, Tap Changer (off load and on load) (Brief idea) 4.2 Types of three phase transformer i.e. delta-delta, delta-star, star-delta and starstar 4.3 Star delta connections (relationship between phase and line voltage, phase and line current) 4.4 Conditions for parallel operation (only conditions are to be studied) 4.5 On load tap changer 4.6 Difference between power and distribution transformer 4.7 Cooling of transformer 4.8 Rating and Specifications of three phase transformers	**14**

LIST OF PRACTICALS

1. To measure the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase-winding in sequence

OR

Measurement of the angular displacement of the rotor of a slip-ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding

2. Speed control of DC shunt motor (i) Armature control method (ii) Field control method
3. Study of DC series motor with starter (to operate the motor on no load for a moment)
4. Determine efficiency of DC motor by Swinburne's Test at (i) rated capacity (ii) half full load
5. To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load
6. To find the efficiency and regulation of single phase transformer by actually loading it.
7. Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations
8. Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions such as

(a) Star-star
(b) Star-delta
(c) Delta-star
(d) Delta - Delta configuring conditions.

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, Education Pvt Ltd. New Delhi
2. Electrical Machine by B.L. Thareja, S. Chand Publication, New Delhi.
3. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
4. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
5. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi
6. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

ENVIRONMENTAL STUDIES

L T P

2 0 0

COURSE OBJECTIVE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- *Comprehend the importance of ecosystem and sustainable.*
- *Demonstrate interdisciplinary nature of environmental issues*
- *Identify different types of environmental pollution and control measures.*
- *Take corrective measures for the abatement of pollution.*
- *Explain environmental legislation acts.*
- *Define energy management, energy conservation and energy efficiency*
- *Demonstrate positive attitude towards judicious use of energy and environmental protection*
- *Practice energy efficient techniques in day-to-day life and industrial processes.*
- *Adopt cleaner productive technologies*
- *Identify the role of non-conventional energy resources in environmental protection.*
- *Analyze the impact of human activities on the environment.*

DETAILED CONTENTS

UNIT-1, Introduction	**PERIODS**
Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.	**05**
UNIT-2, Air Pollution	**PERIODS**
Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.	**05**
UNIT-3, Water Pollution	**PERIODS**
Impurities in water Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.	**10**
UNIT-4, Soil & Noise Pollution	**PERIODS**
Sources of soil pollution, Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste, Effect of Solid waste, Disposal of Solid Waste- Solid Waste Management. Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.	**10**
UNIT-5, Environmental Legislation	**PERIODS**
Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air	**10**

(Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).	

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of pH of soil
7. To measure the noise level in classroom and industry.
8. To segregate the various types of solid waste in a locality.
9. To study the waste management plan of different solid waste
10. To study the effect of melting of floating ice in water due to global warming

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications , New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. 7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons,
8. New Delhi.
9. E-books/e-tools/relevantsoftware to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

INDUSTRIAL TRAINING

L T P

0 0 0

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Presentation and VIVA 15%.
d) Industrial training report 55%

INDUSTRIAL ELECTRONICS AND CONTROL

L T P

2 1 0

COURSE OBJECTIVES

Industrial electronics plays a very vital role in the field of Control Engineering specifically in the modern industries as they mostly use electronic controls, which are more efficient, effective and precise as compare to the conventional methods. The old magnetic and electrical control schemes have all become obsolete. Electrical Engineering diploma holder, many times, has to maintain the panels used in the modern control process. Therefore, the knowledge of components like thyristors and other semiconductor devices used in such control panels is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance of this subject, it has been incorporated in the curriculum

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- Use Power diode with load R and R-L.
- Use SCR, TRIAC and Diac as per requirement of circuit
- Control fan speed using Triac and Quadriac
- Control speed of D.C. shunt motor or universal motor
- Demonstrate the output wave shape on CRO
- Repair UPS and Inverter
- Maintain storage batteries
- Maintain panels used in the modern control process

DETAILED CONTENTS

UNIT-1: Introduction to SCR	PERIODS
1.1 Power diode characteristics, application of general purpose diode, fast recovery diode and Schottkey diode, use in R, RL series circuit. 1.2 Construction and working principles of an SCR, two transistor analogy and characteristics of SCR 1.3 SCR specifications and rating 1.4 Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac 1.5 Basic idea about the selection of heat sinks for SCR and TRIACS 1.6 Methods of triggering a Thyristor. Study of triggering circuits 1.7 UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator 1.8 Commutation of Thyristors 1.9 Series and parallel operation of Thyristors 1.10 Applications of SCR, TRIACS and Quadriac such as light intensity control,	**16**

speed control of DC and universal motor, fan regulator, battery charger etc. 1.11 dv/dt and di/dt protection of SCR.	
UNIT-2: Controlled Rectifiers	**PERIODS**
2.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of freewheeling diode. 2.2 Single phase half controlled full wave rectifier 2.3 Single phase fully controlled full wave rectifier 2.4 Single phase full wave centre tapped rectifier 2.5 Three phase full wave half controlled bridge rectifier 2.6 Three phase full wave fully controlled bridge rectifier	**06**
UNIT-3: Inverters, Choppers, Dual Converters and Cyclo Convertors	**PERIODS**
3.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications 3.2 Choppers-introduction, types of choppers and their working principles and applications 3.3 Dual converters-introduction, working principles and applications 3.4 Cyclo-converters- introduction, types, working principles and applications	**05**
UNIT-4: Thyristor Control of Electric Drives	**PERIODS**
4.1 DC drives control (Basic Concept) 4.2 Half wave drives 4.3 Full wave drives 4.4 Chopper drives 4.5 AC drives control 4.6 Phase control 4.7 Variable frequency a.c. drives 4.8 Constant V/F application 4.9 Voltage controlled inverter drives 4.10 Constant current inverter drives 4.11 Cyclo convertors controlled AC drives 4.12 Slip control AC drives	**08**
UNIT-5: Uninterrupted power supplies	**PERIODS**
5.1 UPS online, off line 5.2 Storage devices (batteries) 5.3 SMPS, CVT	**05**

LIST OF PRACTICALS

1. To draw V-I characteristics of an SCR
2. To draw V-I characteristics of a TRIAC
3. To draw V-I characteristics of a
4. To draw uni-junction transistor characteristics
5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC Quadriac (fabrication of this circuit)
8. Speed-control of a DC shunt motor or universal motor

9. To observe the output wave shape on CRO of
(a) Single phase half controlled full wave rectifier
(b)Single phase controlled rectifier

RECOMMENDED BOOKS

1. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions. 2. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
3. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
4. Power Electronics by PC Sen
5. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
6. Industrial Electronics & Control by SK Bhattacharya & S Chatterji, New Age international Publications(P) Ltd, New Delhi
7. Power Electronics by SK Sahdev, Uneek Publication, Jalandhar
8. Industrial Power Electronics by JC Karhava, King India Publication,
9. Power Electronics and Controls by Samir K Datta, Prentice Hall of India, New Delhi 10. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

ELECTRICAL DESIGN, DRAWING AND ESTIMATING – I

L T P

2 1 1

COURSE OBJECTIVES

A diploma holder in Electrical Engineering is supposed to have ability to read, understand and Interpret engineering drawings and communicate through sketches and drawings. He is also expected to prepare working drawings of panels, transmission, and distribution. The contents of This subject has been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering

COURSE OUTCOMES

After undergoing the subject, students will be able to:
- Recognize various electrical devices and their symbols
- Recognize various electrical devices placed on the panels/distribution boards and to Design the panels
- Recognize the internal details of various electrical machines and devices
- Read schematic and wiring diagrams of electrical devices
- Read and interpret electrical installation plan
- Communicate about circuits and devices through sketches and drawings
- Determine various types of wiring systems and their use
- Practice and execute any type of wiring
- Estimate and determine the cost of wiring installation
- Estimate the material required for HT and LT lines
- Prepare a tender document for a particular job
- Estimate the material required for pole-mounted sub-stations

DETAILED CONTENTS

UNIT-1, Symbols and Signs Conventions, Wiring Diagram	**PERIODS**
Various Electrical Symbols used in Domestic and Industrial Installation and Power System (Generation, Transmission and Distribution including Sub-stations) as per BIS Code, . Wiring diagram of light, fan, bell and alarm circuits. Staircase and godown wiring Traffic light signal control circuit at crossroads	**10**
UNIT-2, Panels/Distribution Boards	**PERIODS**
Design and Drawing of panels/Distribution board using MCB, ELCB main switches and change over switches for domestic installation, industrial and commercial installation.	**06**
UNIT-3, Orthographic projections of Simple Electrical Parts	**PERIODS**
• Bus bar post/ Kit Kat	**08**

• Pin type and shackle type insulator (Pin Type 11kV/66kV) • Bobbins of a small transformer / choke • Stay insulators/Suspension type insulators • Rotor of a squirrel cage induction motor • Motor body (induction motor) as per IS Specifications (using outside dimensions) • Slip rings of 3-phase induction Motor. • Stator of 3 phase Induction motor (Sectional View)	
UNIT-4, Introduction to Estimating & Costing	**PERIODS**
Purpose of estimating and costing, proforma for making estimates, preparation of materials schedule, costing, price list, preparation of tender document (with 2-3 exercises), net rice list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills.	**08**
UNIT-5, Types of Wiring	**PERIODS**
Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire-gauge and tables (to be prepared/arranged)	**08**

LIST OF PRACTICALS

1. Framing of Tender and reply to tender to get job/project
2. Identification of wiring for different applications
3. Prepare an estimate for a Two room residential building as per given plan
4. Prepare an estimate for service connection for residential building having connected load

RECOMMENDED BOOKS

1. Electrical Engineering Design and Drawings by Surjeet Singh, Dhanpat Rai and Co, New Delhi
2. Electrical Engineering Design and Drawings by SK Bhattacharya, SK Kataria and Sons, New Delhi
3. Electrical Engineering Design and Drawings by Ubhi& Marwaha, IPH, New Delhi
4. Electrical Design and Drawing by SK Sahdev, Uneek Publications, Jalandhar
5. Electrical Engineering Drawing by Surjit Singh, SK Kataria and Sons, New Delhi
6. Electrical Installation, Estimating and Costing by JB Gupta, SK Kataria and Sons, New Delhi
7. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi
8. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi
9. Estimating and Costing by Praveen Kumar; North Publication, Jalandhar
10. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi

11. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi
12. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

L T P

2 1 1

COURSE OBJECTIVES

The majority of the diploma pass outs who get employment in State Electricity Boards have to perform various activities in the field of transmission and distribution of electrical power. The range of these activities vary from simple operation and maintenance of equipment, lines, fault location, planning and designing of simple distribution schemes, executive and supervisory control in transmission and distribution networks in addition to administrative jobs including public relations. They should also be made aware of recent developments, current practices in the electricity departments, corporations and boards to keep them abreast with modern techniques in transmission and distribution of electrical power.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- Select suitable supporting structure, insulators, conductors and other accessories for transmission lines and distribution lines
- Prepare layout plan for HT and LT lines/distribution system
- Prepare estimate for HT and LT (OH and underground cables) lines
- Operate and maintain indoor and outdoor substations
- Use various methods for improvement of power factor
- Assess the revenue and energy loss in power distribution

DETAILED CONTENTS

UNIT-1, Transmission Systems	PERIODS
1.1 Layout of transmission system, selection of voltage for H.T and L.T lines, advantages of high voltage for Transmission both AC and DC 1.2 Comparison of different system: AC versus DC for power transmission, conductor material and sizes from standard tables 1.3 Constructional features of transmission lines: Types of supports, types of insulators, Types of conductors, Selection of insulators, conductors, earth wire and their accessories, Transposition of conductors and string efficiency of suspension type insulators, Bundle Conductors. 1.4 Mechanical features of line: Importance of sag, calculation of sag, effects of wind and ice related problems; Indian electricity rules pertaining to clearance 1.5 Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission line, voltage regulation, and concept of corona. Effects of corona and remedial measures 1.6 Transmission Losses	**15**

1.7 Economic Principle of Transmission Kelvin's law, limitation of Kelvin's law modification in Kelvin's law	
UNIT-2, Distribution System	**PERIODS**
2.1 Lay out of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC radial distribution system, determination of size of conductor 2.2 Preparation of estimates of HT and LT lines (OH and Cables). 2.3 Constructional features of LT (400 V), HT (II kV) underground cables, advantages and disadvantages of underground system with respect to overhead system. 2.4 Losses in distribution system 2.5 Faults in underground cables-determine fault location by Blavier Test, Murray Loop Test, Varley Loop Test	**10**
UNIT-3, Substations:	**PERIODS**
3.1 Brief idea about substations; out door grid sub-station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation 3.2 Layout of 33/11 KV & 220/33KV distribution substation and various auxiliaries and equipment associated with it.	**05**
UNIT-4, Power Factor:	**PERIODS**
4.1 Concept of power factor 4.2 Reasons and disadvantages of low power factor 4.3 Methods for improvement of power factor using capacitor banks, Static VAR Compensator (SVC)	**05**
UNIT-5, Revenue and Energy loss	**PERIODS**
Technical losses and Commercial losses, Input energy calculation, Sales calculation, Billing efficiency, Collection efficiency, Total energy billed (KWH), Percent aggregated technical and commercial losses.	**05**

RECOMMENDED BOOKS

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
2. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
3. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
4. Electrical Power System by VK Mehta, S Chand and Co., New Delhi
5. Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi
6. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
8. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi
9. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

ENERGY CONSERVATION

L T P

3 0 0

COURSE OBJECTIVE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- *Define principles and objectives of energy management and energy audit.*
- *Understand Energy Conservation Act 2001 and its features.*
- *Understand various forms & elements of energy.*
- *Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.*
- *Identify areas of energy conservation and adopt conservation methods in various systems.*
- *Evaluate the techno economic feasibility of the energy conservation technique adopted*.

DETAILED CONTENTS

UNIT-1, Basics energy	**PERIODS**
Classification of energy- primary and secondary energy, commercial and noncommercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators. Global fuel reserve, Energy scenario in India and state of U.P. Sector-wise energy consumption (Domestic, industrial, agricultural and other sectors), Impact of energy usage on climate.	**06**
UNIT-2, Energy Conservation and EC Act 2001	**PERIODS**
Introduction to energy management, energy conservation, energy efficiency and its need, Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation. Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating.	**06**
UNIT-3, Electrical Supply System and Motors	**PERIODS**
Types of electrical supply system, Single line diagram, Losses in electrical power distribution system, Understanding Electricity Bill: Transformers Tariff structure, Components of power, (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC) Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers, Electric Motors Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors.	**12**
UNIT-4, Energy Efficiency in Thermal Utilities & General Energy Saving Tips	**PERIODS**

& Energy Audit	
Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE), Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces, Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers, Efficient Steam Utilization	**11**
UNIT-5, Energy Conservation Building Code & waste heat recovery and Co-generation	**PERIODS**
ECBC and its salient features, Tips for energy savings in buildings: New Buildings, Existing Buildings. Concept, classification and benefits of waste heat recovery, Concept, and types of co-generation system.	**5**

PRACTICAL EXERCISE

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy
5. Consumption by centrifugal pump.
6. 5. To measure and calculate energy saving by arresting air leakages in compressor.
7. 6. To measure the effect of blower speed on energy consumed by it.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015.
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015.
3. 3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015.
4. Handbook on Energy Audit & Environmental Management by Y P Abbi &Shashank Jain published by TERI. Latest Edition.

FCS406	AI for Engineering	L T P 3 0 0	3 credits

CourseObjectives:

CO1	To understand the concepts of Artificial Intelligence (AI).
CO2	To understand strength of and weakness of searching algorithms.
CO3	To learn and compare the searching techniques for AI applications.
CO4	To acquaint with the various knowledge representation & experts' systems.
CO5	To understand basic probability notations in artificial Intelligence/ Game theory.

Unit-I

Introduction: History & overview of Artificial Intelligence, Different Definitions, Problem Solving Strategies,Applications, Physical Symbol System Hypothesis, production systems, Characteristics of production, Agentsand Environments,Concept of rationality,Nature of environments,Structure of agents.

Unit-II

Searching Techniques: Search Strategies-Informed-Uninformed Search, depth first search, breadth firstsearch,Heuristic Search Strategies, Evolutionary algorithms Local Search Algorithms, Backtracking Search – Game Playing – OptimalDecisions in Games – Alpha – Beta Pruning.

Unit-III

KNOWLEDGE REPRESENTATION: Syntax and semanticsof First Order Logic,Prolog Programming,Forward ChainingBackwardChaining Resolution,KnowledgeBased Agents, Example, Propositional Logic,Reasoning Patterns in Propositional Logic, Inference in First Order Logic Knowledge Base Reasoning Systems for Categories.

Unit-IV

Game Playing: Constraint Satisfaction Problems(CSP), constraint propagation, backtracking search for CSP, local search forCSP, structure of CSP , Minimax& Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions.

Unit-V

APPLICATIONS: AI applications, Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robot, Hardware, Perception, Planning & Moving.

Fuzzy logic,Probabilistic Reasoning Structured knowledge, graphs, frames and related structures.

TextbooksandReferences:

1. Artificial Intelligence by Luger (Pearson Education).

2. Artificial Intelligence, A Modern Approach. Stuart Russell and Peter Norvig.
3. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
4. Introduction to AI & Expert System: Dan W.Patterson, PHI.

COURSEOUTCOMES:

CO1	To understand the fundamentals of Artificial Intelligence.
CO2	To design smart system using different search strategies of Artificial Intelligence.
CO3	To analyze various basic probability notations, game theory.
CO4	Implement Artificial Intelligence solutions using logical reasoning.
CO5	To apply various algorithms for Artificial Intelligence application development.

UNIVERSAL HUMAN VALUES

L T P

2 0 0

COURSE OBJECTIVE

This introductory course input is intended

1. *To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.*
2. *To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.*
3. *To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature*

Thus, this course is intended to provide a much needed orientation input in value education to the young enquiring minds.

Course Methodology

1. *The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-a-vis the rest of existence.*
2. *It is free from any dogma or value prescriptions.*
3. *It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.*
4. *This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self evolution.*
5. *This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.*

DETAILED CONTENT

UNIT-1, Course Introduction- Need, Basic Guidelines, Content and Process for Value Education	**PERIODS**
Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	**08**
UNIT-2, Understanding Harmony in the Human Being- Harmony in Myself!	**PERIODS**
Understanding human being as a co-existence of the sentient 'I' and the material the Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail ,Programs to ensureSanyam and Swasthya -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**06**
UNIT-3, Understanding Harmony in Family and Society- Harmony in	**PERIODS**

Human-Human Relationship	
Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family! -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**08**
UNIT-4, Understanding Harmony in the Nature and Existence- Whole existence as Co-existence	**PERIODS**
Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**04**
UNIT-5, Implications of the above Holistic Understanding of Harmony on Professional Ethics	**PERIODS**
Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics, Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations, To inculcate Human Values among Students: The Role of self ,Parents and Teachers. Practice Exercises and Case Studies will be taken up in Practice Sessions.	**08**

Reference Material

The primary resource material for teaching this course consists of

a) The text book (Latest Edition) R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
b) The teacher's manual (Latest Edition) R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Ivan Illich, 1974, Energy & Equity, the Trinity Press, Worcester, and HarperCollins, USA.

5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, and Universe Books.

SWITCHGEAR AND PROTECTION

L T P

2 1 0

COURSE OBJECTIVES

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma passouts have become more complex than what they used to be earlier. He is required to work with modern electrical equipment and maintain reliability of supply.
The course is designed to develop understanding of the principles and working of protective switchgear so that one can handle, install and maintain them and also take decisions at his level in different situations.
This subject teaching requires reinforcement from visits to substations, power stations and well designed laboratory experiences. A practical orientation to the teaching of this subject is suggested.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- assess type of fault diagnosis
- know circuit breaker operation
- know relay operation
- know read about protection schemes
- Know about different types of substations and read single line diagrams

DETAILED CONTENTS

UNIT-1, Faults	**PERIODS**
Types of faults, three phase symeterical faults, effects of faults on system reliability and stability, abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams	**05**
UNIT-2, Switchgear	**PERIODS**
2.1 Purpose of protective gear, characteristics of a protection system. 2.2 Classification of fuses H.V. Fuses, application and working, grading and coordination L.V. fuses, selection of fuses, characteristics 2.3 Isolators and switches, outdoor isolators, functions, air break switches, braking capacity of switches. 2.4 Circuit breakers :- requirements of circuit breakers, definition of terms associated with circuit-breakers, reasons for arc formation, principles of arc extinction, types of circuit-breakers, comparison with oil circuit breaker,	**10**

classification, rating of circuit breakers, working of different types of air and oil circuit breakers, specification of circuit breakers, maintenance schedule, SF-6 and Vacuum circuit breakers. 2.5 Relays:Requirement of relays, operation principles, induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction too distance relay.	
UNIT-3, Protective Schemes	**PERIODS**
3.1 Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults - their reasons, effect and protections used. 3.2 Protection of power transformer: types of faults, its effects, types of proective schemes over current, earth fault, differential protection, Buckholtz devices, winding temp. protection. 3.3 Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection. 3.4 Protection of feeders: radial, parallel and ring feeders protection, directional time and current graded schemes, differential protection.	**10**
UNIT-4, Protection Against Over Voltages	**PERIODS**
Causes of over voltages, travelling waves earth wire, protective zone, lightening arrestors, space-gap and electrolytic arrestors, surge absorber, location and rating of lighening arrestors. Thyrite lightening arrestor.	**05**
UNIT-5, Different Type of Sub-stations	**PERIODS**
5.1 Layout, single line diagram, busbar arrangement, equipment, their fuctions, accessories, study of protective schemes, batteries and their maintenance, operation of small sub-stations. 5.2 Reactors: types of reactors, busbar reactor, tuning reactor, arc-supression reactor, connection of reactors in power stations, uses of reactors. 5.3 Neutralgrounding:- types of grounding solid grounding, reactance grounding, arc suppression, coil grounding, choice of method of neutral earthing, grounding of sub-stations, grounding of line structure and substation equipment. 5.4 Concept of G.I.S. (Gas Insulated Substation	**10**

RECOMMENDED BOOKS

1. Switchgear and Protection by NagrathKathan; TMH
2. Switchgear and Protection by Soni Gupta &Bhatnagar; Dhanpat Rai & Sons
3. Switchgear and Protection by Sunil S. Rao; Dhanpat Rai & Sons
4. Switchgear and Protection by HarnoonAsfaqHussain; Khanna Publications
5. Switchgear and Protection by J.B. Gupta; Kataria& Sons
6. Switchgear and Protection by U.A Bakshi; Technical Publications, Pune

PLC, MICRO CONTROLLER & SCADA

L T P

2 1 1

COURSE OBJECTIVES

A diploma holder, employed in automated industrial process controls or in automated power station, will be required to know the basic of programmable logic controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation system was mechanical in design, timing and sequencing being effected by gears and cams. Now this design concept was replaced by programmable logic controllers (PLC). A PLC is a solid state device. PLCs are widely used in all industries for efficient control operations. Looking at the industrial applications of PLCs in the industry, this subject finds its usefulness in present curriculum.

Microcontrollers and SCADA have also assumed great significance in the field of electronics, power system, large industry and engineering field. This subject aims to expose the diploma students to both of these and give them adequate knowledge of these topics.

DETAILED CONTENTS

UNIT-1, Introduction	**PERIODS**
Concept of PLC, building block of PLC, function of various blocks, limitation of relays, advantage of PLC over electromagnetic relays, different programming languages, PLC manufacturer, working of PLC, basic operation and principles of PLC,architectural details.	**10**
UNIT-2, Instruction Set	**PERIODS**
2.1 Basic instructions like latch, master control self holding relays, timer instruction like retentive timers, resetting of timers, counter instructions like up counter, resetting of counters. 2.2 LadderDiagram Programming : programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.	**10**
UNIT-3, Microcontroller series (MCS)-51 over view	**PERIODS**
Pin details, I/O ports structure, memory organisation, special function registers instruction set, addressing modes, timers operation, serial port operation, interrupts.	**05**
UNIT-4, Assembly language programming	**PERIODS**
Assemblers and Compilers, assembler directives, design and interface. Examples like: keypad interface, 7- segment interface, LCD, Stepper motor , A/D, D/A , RTC interface, introduction of PIC microcontrollers.	**05**

UNIT-5, SCADA	PERIODS
Introduction, role of SCADA in dispatch centre, operator console, VDUs, types of communication channels in SCADA systems, RTUs, MTUs, data loggers, report generation, report analysis and actions.	**10**

LIST OF PRACTICALS

1. Components / sub components of aPLC, learning functions of different modules of a PLCs
2. Practical steps in programming a PLC (a) using hand held programmer (b) using computer interface.
3. Introduction to step programming language, ladder diagram concepts, instruction list syntax.
4. Basic logic operations, AND, NOT, OR functions
5. Use of PLC for an application

Car parking, doorbell operation, traffic light control, washing machine, motor in forward and reverse direction

Microcontrollers

6. Familiarization of micro controllers (8051) kit
7. Testing of general input/ output on micro controller board
8. Use of micro controller liken in relays, buzzer of working machine, oven

RECOMMENDED BOOKS

1. Introduction to PLCs by Gary Dunning , McGraw Hill
2. Module on PLCs and their applications by Rajesh Kumar, NITTTR Chandigarh
3. Micro controller by Ayala, Penram International
4. Power system SCADA and smart Grids by Mini S. Thomas and John D. McDonald

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

ELECTRICAL MACHINES – II

L T P

3 0 0

COURSE OBJECTIVES

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance.
Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

COURSE OUTCOMES

After undergoing the subject, students will be able to:

• Demonstrate the constructional features of a synchronous machine and its working as a synchronous motor
• Operate the synchronous motor as synchronous condenser
• Use 3-φ induction motor in the industry for various operations
• Operate and maintain three phase squirrel cage and three phase slip ring induction motors.
• Start and reverse the direction of rotation of three phase induction motors using different types of starters.
• Conduct speed control of three phase induction motor.
• Operate and maintain double cage induction motors.
• Recognize the condition of cogging and crawling in three phase induction motors.
• Operate different types of single phase induction motors.
• Operate different types of special purpose motors

DETAILED CONTENTS

UNIT-1, Phase Induction Motors	PERIODS
1.1 Production of rotating magnetic field in 3 phase winding. 1.2 Salient constructional features of squirrel cage and slip ring 3-phase induction motors 1.3 Principle of operation, slip and its significance 1.4 Locking of rotor and stator fields 1.5 Rotor resistance, inductance, emf and current 1.6 Relationship between rotor copper losses, slip and rotor input power. 1.7 Power flow diagram of an induction motor 1.8 Factors determining the torque 1.9 Torque-slip curve, stable and unstable zones 1.10 Effect of rotor resistance upon the torque slip curve	**15**

1.11 Double cage rotor motor and its applications 1.12 Starting of 3-phase induction motors, DOL, star-delta, auto transformer starter. 1.13 Causes of low power factor of induction motors 1.14 Testing of 3-phase motor on no load and blocked rotor test and to find efficiency 1.15 Method of Speed control of induction motor 1.16 Harmonics and its effects, cogging and crawling in Induction Motors. 1.17 Specifications and ratings of induction motors.	
UNIT-2, Single Phase Motors	**PERIODS**
2.1 Single phase induction motors; Construction characteristics, specifications and applications. 2.2 Nature of field produced in single phase induction motor-double revolving field theory. 2.3 Split phase induction motor 2.3.1 Capacitor start, capacitor run, capacitor start and run motor 2.3.2 Shaded pole motor 2.4 Alternating current series motor and universal motors, construction,working principle and operation, application. 2.5 Single phase synchronous motor 2.5.1 Reluctance motor 2.5.2 Hysteresis motor	**10**
UNIT-3, Synchronous Overview	**PERIODS**
3.1 Main constructional features of synchronous machine including commutator and brushless excitation system 3.2 Generation of three phase emf 3.3 Concept of distribution factor and coil span factor and emf equationArmature reaction at unity, lag and lead power factor 3.4 Equivalent circuit diagram of synchronous machine 3.5 Concept of voltage regulation. Determination of voltage regulation by synchronous impedance method.	**05**
Unit -4, **Machines Applications**	
4.1Operation of single synchronous machine independently supplying a load. 4.2 Concept of infinite bus bar. Need and necessary conditions of parallel operation of alternators, synchronizing an alternator (Synchroscope method) with the bus bars 4.3 Operation of synchronous machine as a motor –its starting methods 4.4 Effect of change in excitation of a synchronous motor, V curve, Concept of synchronous condenser. 4.5 Concept and cause of hunting and its prevention 4.6 Specification, rating and cooling of synchronous machines 4.7 Applications of synchronous machines	**05**
UNIT-4, Special Purpose Machines	**PERIODS**
Construction, working principle and application of linear induction motor, stepper	**05**

motor, AC Servomotor, Submersible Motor,	

LIST OF PRACTICALS

1. Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)

2. Determination of effect of rotor resistance on torque speed curve of an induction motor Observe the performance of a ceiling fan (I-φ) induction motor) without capacitor

3. Determine the effect of change in capacitor on the performance of 1-phase induction motor and reverse the direction of motor.

4. To plot relationship between no load terminal voltage and excitation current in a synchronous generator at constant speed

5. Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant

6. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test

7. Determination of the effect of variation of excitation on performance of a synchronous Motor

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
2. Electrical Machine by B.L.Thareja; S.ChandPublicaion, New Delhi
3. Electrical Machines by SK Sahdev; Uneek Publications, Jalandhar
4. Electrical Machines by Nagrath and Kothari; Tata McGraw Hill, New Delhi
5. Electrical Engineering by JB Gupta; SK Kataria and sons, New Delhi
6. Electrical Machines by Samarjit Ghosh; Pearson Education (Singapore) Pvt, Ltd.Delhi
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR,Chandigarh.

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

RENEWABLE SOURCES OF ENERGY

L T P

3 0 0

COURSE OBJECTIVES

Since the conventional energy resources are under fast depletion, it is high time to tap the non-conventional energy sources also. So, the solution primarily lies in tapping all possible energy generation sources but efficient use of available energy is also important. The electrical diploma holder must be made aware about saving and conserving Electrical Energy and tackle the problems of environmental pollution as they will have to face this challenge in future life. Hence the subject..

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Explain the importance of non-conventional energy sources for the present energy scenario.
- Classify various non-conventional sources of energy
- Explain principle of solar photovoltaic energy conversion and the applications of solar energy in different fields.
- Explain basic conversion technologies of biomass, wind energy, geo-thermal, tidal energy, hydro energy and its applications.
- Explain direct energy conversion systems like magneto hydrodynamics and fuel cells and its applications

DETAILED CONTENTS

UNIT-1 : Basic of Energy	**PERIODS**
Classification of Energy-primary and secondary energy, commercial and noncommercial energy, importance of non conventional energy sources, present scenario,future prospectus, energy scenario in India,sector-wise energyconsumption (domestic, industrial, agriculture etc.), comparison between renewable andnon renewable energy resources	**10**
UNIT-2: Solar Energy	**PERIODS**
Principle of conversion of solar radiation into heat, using different types of solar collectors, photo-voltaic cell, electricity generation, application of solar energy like solar water heaters, solar furnaces, solar cookers, solar lighting, solar pumping, installation & maintenance of solar power plant	**10**
UNIT-3: Wind Energy	**PERIODS**
Wind energy conversion, windmills, electricity generation from wind- types of wind mills, local control, energy storage	**05**
UNIT-4: Geo-thermal and Tidal Energy	**PERIODS**
Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion. Steam Generation	**10**

and electricity generation. Different types of tidal energy systems	
UNIT-5: Hydro Energy	**PERIODS**
Mini & Micro hydro plants	**05**

RECOMMENDED BOOKS

1. Non-Conventional Energy Resources by RK Singal; SK Kataria and Sons, New Delhi
2. Solar Energy Utilization; GD Rai; Khanna Publishers, New Delhi.
3. Reviews of Renewable Energy Sources, Vol. 3, Edited by MS Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.
4. Renewable Energy Sources and Conversion Technology by NK Bansal, Manfred Kleemann, Michael Meliss; Tata McGraw Hill Publishing Co. Ltd New Delhi.
5. Energy Today and Tomorrow; Maheshwar Dayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
6. Energy Technology (Nnon-Conventional, Renewable and Conventional) by S Rao and BB Parulekar; Khanna Publishers, New Delhi
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

POWER PLANT ENGINEERING

L T P

2 0 0

COURSE OBJECTIVES

The majority of the diploma pass outs who get employment in State Electricity Boards have to perform various activities in the field of generation, transmission and distribution of electrical power . The range of these activities vary from simple operation and maintenance of equipment, lines, fault location, planning and designing of simple distribution schemes, executive and supervisory control in power stations, transmission and distribution networks in addition to administrative jobs including public relations. They should also be made aware of recent developments, current practices in the electricity departments, corporations and boards to keep them abreast with modern techniques in transmission and distribution of electrical power.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- Distinguish and select suitable resource of energy required for a particular area and environment
- Calculate effective cost generation
- Explain the working of various plants for power generation

DETAILED CONTENTS

UNIT-1, Power Generation	PERIODS
1.1 Main resources of energy, conventional and non-conventional 1.2 Different types of power stations-thermal, hydro, gas, diesel and nuclear power stations, comparison of generating stations.	**05**
UNIT-2, Thermal Station	**PERIODS**
2.1Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of make up water, choice of pressure of steam generation and steam temperature, selection of appropriate vaccum; economizer, air pre-heater feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant heat balance and efficiency.	**10**
UNIT-3, Hydro-Electric Plant	**PERIODS**
Hydrology, stream flow, hydrograph, flow duration curves. Types of hydroelectric plants and their fields of use, capacity calculations for hydropower, Dams, head water control, penstrocks, water turbines, specific speeds, turbine governors. Hydroplant auxiliaries, plant layout, automatic and remote control of hydroplants, pumped storage projects, cost of hydro-electric projects. Cooling of alternators.	**12**

UNIT-4, Nuclear Power Plant	PERIODS
Elements of nuclear power plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.	**06**
UNIT-5, Non Conventional Source of Energy	**PERIODS**
Introduction, Concept of Solar Energy, Bio Mass Energy, Wind Energy, Tidal Energy, Geothermal Energy, Microhydel Energy, Biodiesel Energy.	**07**
Introduction, Concept of Solar Energy, Bio Mass Energy, Wind Energy, Tidal Energy, Geothermal Energy, Microhydel Energy, Biodiesel Energy.	

RECOMMENDED BOOKS

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
2. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
3. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
4. Electrical Power System by VK Mehta, S Chand and Co., New Delhi
5. Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi
6. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
8. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi
9. Electrical Power by Soni Gupta and Bhatnagar; Dhanpat Rai & Sons, New Delhi
10. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

INDUSTRIAL MANAGEMENT AND ENTREPRENERSHIP DEVELOPMENT

L T P

3 0 0

COURSE OBJECTIVE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organization.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organization.
- Use marketing skills for the benefit of the organization.
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, JIT and CRM.

DETAILED OUTCOMES

UNIT-1, Introduction to Entrepreneurship	PERIODS
Concept /Meaning and its need, Qualities and functions of entrepreneur and barriers in entrepreneurship, Sole proprietorship and partnership forms and other forms of business organizations, Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organization: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks.	08
UNIT-2, Market Survey and Opportunity Identification/Ideation	PERIODS
Scanning of the business environment, Salient features of National and Haryana State industrial policies and resultant business opportunities, Types and conduct of market survey, Assessment of demand and supply in potential areas of growth, Identifying business opportunity, Considerations in product selection, Converting an idea into a business opportunity.	08
UNIT-3, Project report Preparation	PERIODS
Preliminary project report, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report Sample project report.	08
UNIT-4, Introduction to Management	PERIODS

Definitions and importance of management, Functions of management: Importance and process of planning, organizing, staffing, directing and controlling, Principles of management (Henri Fayol, F.W. Taylor), Concept and structure of an organization, Types of industrial organizations and their advantages, Line organization, staff organization, Line and staff organization, Functional Organization.	08
UNIT-5, Leadership and Motivation	PERIODS
Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders, Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor).	08

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL EQUIPMENT

L T P

2 1 1

COURSE OBJECTIVES

In his career as a supervisor, an electrical engineering technician will be called upon to inspect, test and modify the work done by skilled workers or artisans working under him. Many a times, it will become necessary for him to demonstrate the correct method and procedure of doing certain operations. Normally manufacturers of heavy electrical equipment provide service manuals, instructions for installation, maintenance and fault location. Indian Electricity Rules and Indian Standard Specifications also provide enough guidelines. This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities. Appropriate field trips will reinforce the learning.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:
- Erect/install various electrical equipment as per IE Rules Act by adopting all safety measures.
- Prepare specifications for different items required for transmission lines.
- Design and excavation of cable trenches.
- Lay underground cables
- Test cables and their termination.
- Check HT/LT circuit breakers, transformers and related equipment in a substation
- Carry out earthing, make earth pits and measure earth resistance values.
- Find fault in a transmission/distribution system.
- Carry out preventive maintenance to minimize breakdowns.

DETAILED CONTENTS

UNIT-1: Tools and Accessories	PERIODS
Tools, accessories and instruments required for installation, maintenance and repair work. Knowledge of Indian Electricity rules, safety codes, causes and prevention of accidents, artificial respiration of an electrocuted person, workmen's safety devices	**05**
UNIT-2: Installation	**PERIODS**
2.1 Installation of transmission and Distribution Lines Erection of steel structures, connecting jumpers, tee-off points, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway line crossings, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: Arrangement for suspension and strain insulators, bird guards, anti-climbing devices and danger plates; sizes of conductor, earthwire and guy wires. Laying of service lines, earthing, provision of service fuses, installation of energy meters	**15**

2.2 Laying of Underground Cables Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths and clearances from other services such as: water, sewerage, gas, heating and other mains, and also a series of power and telecommunication cables and coordination with these services, excavation of trenches, direct cable laying, including laying of cable from the drum, laying cable in the trench, taking all measurements and making drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc,) laying of cables into pipes and conduits and within buildings. 2.3 Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolators, voltage and current transformers, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration. Earthing system, fencing of yard, equipment foundations and trenches etc.. 2.4 Testing of various electrical equipment such as electrical motor, transformers, cables, and generators, motor control centres, medium voltage distribution panels, power control centres, motor control centres, lighting arrangement, storage, pre-installation checks, connecting and starting, pre-commissioning checks, drying out 2.5 Testing of Transformers: Typetest, oil testing of transformers	
UNIT-3: Maintenance	**PERIODS**
3.1 Types of maintenance, maintenance schedules, procedures 3.2 Maintenance of Transmission and Distribution System Authorized persons, danger notice, caution notice, permit to work, arranging of shutdowns personally, temporary earthing, cancellation of permit and restoration of supply. Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections; Location of faults using Meggar, effect of open or loose neutral connections, provision of proper fuses on service lines and their effect on system, causes of dim and flickering lights. 3.3 Maintenance of Distribution Transformers Transformer maintenance and points to be attended to in respect of various items of equipment Checking of insulation resistance, transformer oil level and BDV test of oil, measurement of earth resistance 3.4 Maintenance of Grid Substations Checking and maintenance of busbars, isolating switches, HT/LT circuit breakers, LT switches. Power transformers 3.5 Maintenance of Motors Over hauling of motors, preventive maintenance, trouble shooting of electric motors 3.6 Domestic Installation Introduction, testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation and resistance between conductors, continuity or open circuit test	**20**

LIST OF PRACTICALS

1. Testing of Insulation Resistance of PVC in PVC wire, measurement of winding resistance of a motor.
2. Wiring of tube light connection with starter and choke.
3. Oil testing of a transformer and note its breakdown value.
4. Make a alarm circuit.
5. Make ON/OFF control circuit to run an electric induction motor (Single Phase)
6. Make a circuit to run a ceiling fan.

RECOMMENDED BOOKS

1. Testing, Commissioning , Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana
3. Installation and Maintenance of Electrical Equipment by Praveen Kumar, North Publication, Jalandhar
4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

ELECTRICAL DESIGN, DRAWING AND ESTIMATING – II

L T P

2 1 1

COURSE OBJECTIVES

A diploma holder in Electrical Engineering is supposed to have ability to:
i) Read, understand, and interpret electrical engineering drawings
ii) Communicate and correlate through sketches and drawings
iii) Prepare working drawings of electrical circuits, motor control, earthing, and motor parts

The contents of this subject have been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- recognize contactor and its use in various applications of 3 phase induction motor
- recognize different types of earthing
- name relevant IS specification for earthing
- read and interpret key diagrams
- read and interpret schematic and wiring diagrams
- Prepare estimate of wiring installation.
- Prepare estimate of small sub-station.

DETAILED CONTENTS

UNIT-1: Contractor Control Circuits	PERIODS
Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors 1.1 DOL starting of 3-phase induction motor 1.2 3-phase induction motor getting supply from selected feeder 1.3 Forwarding/reversing of a 3-phase induction motor 1.4 Two speed control of 3-phase induction motor 1.5 Limit switch control of a 3-phase induction motor 1.6 Sequential operating of two motors using time delay relay 1.7 Manually generated star delta starter for 3-phase induction motor 1.8 Automatic star delta starter for 3-phase Induction Motor 1.9 Control circuit for cross road signal	**10**
UNIT-2: Earthing	**PERIODS**
2.1 Concept and purpose of earthing 2.2 Different types of earthing, drawings of plate and pipe earthing 2.3 Procedure of earthing, test of materials required and costing and estimating 2.4 Method of reducing earth resistance	**08**

2.5 Relevant IS specifications of earth electrode for earthing a transformer, a high building 2.6 Earthing layout of distribution transformer 2.7 Substation earthing layout and earthing materials 2.8 Line diagram of 11kV, 33kV, 66kV, 132 kV sub-stations	
UNIT-3: Estimation of Internal Wiring Installation	**PERIODS**
Estimation of wiring installation for commercial and industrial buildings such as multistoried hotels, hospitals, schools, colleges, cinema, community centers, public library, high rise residential buildings etc. including design of layout, load estimation, Demand factor and diversity factor, power distribution scheme, list of material with specifications estimation of cost preparing relevant electrical schedule or rate (CPWD or PWD) using latest practices, materials and accessories.	**10**
UNIT-4: Estimation of Power Wiring, Estimation of Overhead and Underground Distribution Lines	**PERIODS**
I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductors distribution board, main switches and starters for power circuits. Cost of equipments and accessories and schedule of material. Estimation and cost of material and work for motors up to 20 H.P., pumpsets and small workshops, Main components of overhead lines-line supports, cross-arm, clamps, conductors and staysets, lightening arrestors, danger plates, anti climbing devices, bird guards, jumpers etc., concerting of poles, earthing of transmission line, formation of lines, specification of materials for O.H. lines, I.S, specification and I.E. rules. Cost of material and work for overhead and undergoing lines up to 11 KV only	**06**
UNIT-5: Estimation of Service Connections, Estimation of Small Sub-Station	**PERIODS**
Service connection, types of service connections-overhead and underground for single story and double story buildings, estimate of materials required for giving service connection to domestic consumers, commercial consumers and industrial consumers at L.T. and H.T. costing of material and work in above cases, Main equipments and auxiliaries installed on the substation. Estimation of materials required for a small distribution substation (indoor and outdoor type-platform and pole mounted). Costing of material and work of above substations	**06**

LIST OF PRACTICALS

1. Earthing
2. Commercial and industrial buildings
3. Power wiring layout and circuits
4. Stays, line crossings, line earthing, end poles and terminal poles, junction poles/towers and transposition
pole/towers.
5. Service connection domestic, industrial and agriculture.
6. Substation layout and bus bar arrangements
7. Machine drawings-induction and synchronous machines.
8. Winding of induction machine, 3phase; 1phase.

9. Reading and interpreting practical drawing of wiring installation and control circuits.
10. Winding of synchronous machine 3 phase. (alternator and synchronous motor)

RECOMMENDED BOOKS

1. Electrical Design and Drawings by Raina & Bhattacharya
2. Electrical Design & Drawings by Sarabjeet Singh
3. IEEE Guide 80 for Earthing, IEEE Publication, New York
4. Electrical Design and Drawing by Surjit Singh, North Publication, Jalandhar
5. BIS for Electrical Earthing
6. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

UTILIZATION OF ELECTRICAL ENERGY

L T P

2 1 1

COURSE OBJECTIVES

This subject assumes importance in view of the fact that an electrical technician has to work in a wide spectrum of activities wherein he has to make selection from alternative schemes making technical and economical considerations; e.g. to plan and design an electrical layout using basic principles and handbooks, to select equipment, processes and components in different situations. The contents have been designed keeping the above objectives in view. Besides giving him basic knowledge in the topics concerned, attempts have been made to ensure that the knowledge acquired is applied in various fields as per his job requirements. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize the students with the new developments in different areas.

COURSE OUTCOMES

After undergoing the subject, the student will be able to:

- Explain different methods of illumination
- Design lighting scheme for domestic, industrial and commercial installation
- Design and select a suitable heating arrangement for a particular job
- Handle and maintain electric welding equipment
- Handle and maintain electrolytic plant
- Find faults in electric circuits of refrigerators
- Suggest electric drives as per need
- Maintain electric traction lines and track

DETAILED CONTENTS

UNIT-1: Illumination	**PERIODS**
1.1 Nature of light, visibility spectrum curve of relative sensitivity of Human eye and wave length of light. 1.2 Definition: Luminous flux, solid angle, intensity, luminous efficiency. Space to height ratio, reflection factor, lux, shadow . 1.3 Different types of lamps, construction and working of incandescent and discharge lamps. Fitting required for filament lamp,mercury vapor, sodium lamp, halogen lamp, CFL, LED lamp. 1.4 Calculation of number of light points for interior illumination calculation of indoor and outdoor illumination levels at different points. 1.5 Time switches, street lighting, flood lighting and its characteristics.	**08**
UNIT-2: Electric Heating and Welding	**PERIODS**
2.1 Advantages of electrical heating 2.2 Heating methods	**12**

2.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances, thermostat control circuit 2.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications 2.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace 2.2.4 Dielectric heating, applications in various industrial fields 2.2.5 Infra-red heating and its applications (construction and working of two appliances) 2.2.6. Microwave heating and its applications (construction and working of two appliances) 2.2.7 Solar Heating 2.3 Calculation of resistance heating elements (simple problems) 2.4 Electric Welding 2.4.1 Advantages of electric welding 2.4.2 Welding methods 2.4.3 Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment 2.4.4 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method and their applications. Power supply requirement. Advantages of using coated electrodes,comparison between AC and DC arc welding, welding control circuits,welding of aluminum and copper	
UNIT-3: Electrolytic Processes	**PERIODS**
3.1 Need of electro-deposition 3.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing 3.3. Equipment and accessories for electroplating 3.4. Factors affecting electro-deposition 3.5. Principle of galvanizing and its applications 3.6 Principles of anodizing and its applications 3.7 Electroplating of non-conducting materials 3.8 Manufacture of chemicals by electrolytic process	**08**
UNIT-4: Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers6, Electric Drives	**PERIODS**
4.1 Principle of air conditioning 4.2 Description of Electrical circuit used in a) Refrigerator, b) Air-conditioner, and c) Water cooler, Advantages of electric drives Characteristics of different mechanical loads Types of motors used as electric drive General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc. Examples of selection of motors for different types of domestic loads	**06**

Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel. Selection of motors for Domestic Appliances	
UNIT-5: Electric Drives	**PERIODS**
Advantages of electric drives Characteristics of different mechanical loads . Types of motors used as electric drive General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc. Examples of selection of motors for different types of domestic loads Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel. Selection of motors for Domestic Appliances	**06**

RECOMMENDED BOOKS

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana
3. Utilization of Electrical Energy by Sahdev, Uneek Publication, Jalandhar
4. A Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
5. Modern Electric Traction by H Partap,Dhanpat Rai & Sons, Delhi
6. Utilization of Electrical Energy by D.R. Arora, North Publication, Jalandhar
7. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa,Wiley Eastern Ltd., New Delhi
8. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

APPLICATIONS OF COMPUTER SOFTWARE IN ELECTRICAL ENGINEERING

L T P

2 0 0

COURSE OBJECTIVES

All equipment, installations, circuits and other electrical and electronic systems in commercial, power, and industrial sector need drawings for their manufacturing, installation, operation, and maintenance. A diploma holder in Electrical Engineering must possess the skill of reading, interpreting different drawings and simulating electrical and electronics circuits for most of the activities. With the evolution of various computer softwares, the conventional role of draftsman has been is now taken over by Computer software. Computer Aided Drawing (CAD) and simulation (MATLAB/SIMULINK) software will be used to perform various practical exercises in this course. This will enable the students to become competent to function in the fast-growing information technology environment by enhancing their computer aided drawing, designing and simulating skills in the field of electrical and electronics engineering.

COURSE OUTCOMES

At the end of this course, the students will be able to:
- Use various symbols and notations in electrical and electronics engineering drawings.
- Interpret drawings and draw interferences.
- Draw various electrical and electronics circuits using CAD software.
- Simulate simple electrical and electronics circuits using simulation software

LIST OF PRACTICALS

1. Draw different types of following rectifier circuits using MATLAB/Simulink/Open Source Software and take print out of
(a)Single phase half wave
(b)Single phase full wave
2. Simulate three resistances in series circuit and find out voltage and current in each resistance.
3. Simulate the following circuits and find out voltage and current in each resistance
(a)Two resistances in parallel
(b)Resistance and inductor in parallel
4. Simulate R-L series circuit and observe voltage wave forms across each component.
5. Simulate R-C series circuit and observe voltage wave forms across each component.
6. Simulate R-L-C series circuit and observe voltage wave forms across each component.
7. Simulate R-L-C parallel circuit and observe current wave forms across each component.

8. Simulate star connection using resistors and observe voltage current relation of line and phase.
9. Simulate delta connection using resistors and observe voltage current relation of line and phase.
10. Simulate single phase half-wave rectifier circuit.

RECOMMENDED BOOKS

1. Computer Aided Electrical Drawing by M. Yogesh, B.S. Nagaraja, N. Nandan, Prentice Hall of India.
2. Mastering electronics workbench: Version 5 and Multisim Version 6 by John Adams, McGraw-Hill, New Delhi
3. Electrical Drafting by S.F. Divalapur, Eastern Book Promoters, Belgaum.
4. Getting Started with MATLAB by Rudra Pratap

DIGITAL ELECTRONICS

L T P

2 0 0

COURSE OBJECTIVES

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design and microprocessors.

LEARNING OUTCOMES

After undergoing this course, the students will be able to*:*

- Explain the importance of digitization.
- Verify and interpret truth tables for all logic gates.
- Realize all logic functions with NAND and NOR gates
- Design and demonstrate adder and subtractor circuits
- Verify and interpret truth tables of multiplexer, demultiplexer, encoder and decoder ICs
- Design and realize different sequential circuit (Flip flops, counters and shift registers)
- Verify performance of different A/D and D/A converters.
- Explain the features and applications of different memories.

DETAILED CONTENTS

UNIT-1, Introduction	**PERIODS**
Distinction between analog and digital signal, Applications and advantages of digital signals	**06**
UNIT-2, Number System	**PERIODS**
Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa, Binary addition and subtraction including binary points. 1's and 2's complement method of addition/subtraction.	**08**
UNIT-3, Logic Gates and Families	**PERIODS**
Concept of negative and positive logic ,Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates, SSI, MSI, LSI, VLSI (Definition) ,Propagation delay, Noise Margin, Fan in, Fan out, Power dissipation, Comparison between TTL, CMOS, ECL, MOS on basis of diff parameter, Introduction to Bipolar logic, MOS, ECL, TTL and CMOS logic families, Basic logic gate using NMOS, PMOS, CMOS	**10**
UNIT-4, Heat Treatment	**PERIODS**
Purpose of heat treatment, solid solutions and its types. Formation and decomposition of Austenite, Martensitic Transformation-simplified Transformation Cooling Curves. Various heat treatment processes- Hardening, tempering, annealing, normalizing, Case hardening and surface Hardening, Hardenability of steels, Selection of case carburizing and induction of hardening steels. Types of heat treatment furnaces (only basis idea).	**06**
UNIT-5, Logic Simplification	**PERIODS**

Postulates of Boolean algebra, De Morgan's Theorems. Implementation of Boolean (logic) equation with gates , Karnaugh map (up to 4 variables) and simple application in developing combinational logic circuits	**06**

LIST OF PRACTICALS

1. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR (EXNOR) gates
2. Realization of logic functions with the help of NAND or NOR gates
3. - Design of a half adder using XOR and NAND gates and verification of its operation - Construction of a full adder circuit using XOR and NAND gates and verify its operation
4. Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch, D flip-flop, JK flip-flops).
1. 5 Verification of truth table for encoder and decoder ICs, Mux and DeMux
5. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
6. To design a 4 bit ring counter and verify its operation.
7. Use of Asynchronous Counter ICs (7490 or 7493)

RECOMMENDED BOOKS

1. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
2. Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
4. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New DelhiE-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

FUTURE UNIVERSITY
Learn · Assimilate · Transcend

ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

L T P

2 1 0

COURSE OBJECTIVES

A diploma holder in Electrical Engineering will be involved in maintenance, repair and reduction of electrical equipment and systems. In addition, he may be required to procure, inspect and test electrical and electronic engineering materials. Knowledge of various types of materials will be needed to execute the above-mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- Identify electrical and electronics engineering materials/component
- Select proper conducting material for a particular application
- Select a proper insulating material for a particular application
- Suggest an alternate material if proper material is not available
- Procure various electrical and electronics engineering material available in the market
- Select proper magnetic material for a particular application
- Make use of engineering material used for fabrication of electrical machine
- Select gaseous material for application

DETAILED CONTENTS

UNIT-1, Classification	**PERIODS**
Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands	**03**
UNIT-2, Conducting Materials	**PERIODS**
2.1 Introduction 2.2 Resistance and factors affecting it such as alloying and temperature etc 2.3 Classification of conducting material as low resistivity and high resistivity materials, low resistance materials 2.3.1 Copper: General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering. 2.3.2 Aluminium: General properties as conductor: resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium,	**10**

solderability, contact resistance. Applications in the field of electrical engineering. 2.3.3 Steel: Mechanical properties of steel, applications in the field of electrical engineering. 2.3.4 Introduction to bundle conductors and its applications. 2.3.5 Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same 2.4 Applications of special metals e.g. Silver, Gold, Platinum etc. 2.5 High resistivity materials and their applications e.g., manganin, constantan, Nichrome, mercury, platinum, carbon and tungsten 2.6 Superconductors and their applications	
UNIT-3, Insulating materials; General Properties:	**PERIODS**
4.1 Electrical Properties: Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant 4.2 Physical Properties: Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness 4.3 Thermal Properties: Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics 4.4 Chemical Properties: Solubility, chemical resistance, weatherability 4.5 Mechanical properties, mechanical structure, tensile structure	**07**
UNIT-4, Insulating Materials and their applications:	**PERIODS**
5.1 Plastics 5.1.1 Definition and classification 5.1.2 Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine-formaldehyde), epoxy resins - their important properties and applications 5.1.3 Thermo-plastic materials: Polyvinyl chloride (PVC), polyethylene, silicones, their important properties and applications 5.2 Natural insulating materials, properties and their applications - Mica and Mica products - Asbestos and asbestos products - Ceramic materials (porcelain and steatite) - Glass and glass products - Cotton - Silk - Jute - Paper (dry and impregnated)	**10**

- Rubber, Bitumen - Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation - Enamels for winding wires - Glass fibre sleeves 5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF- their properties and Applications	
UNIT-5, Magnetic Materials, Special Materials, Materials for Electrical Machines	**PERIODS**
6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, Curie temperature, magnetostriction effect. 6.2 Soft Magnetic Materials: 6.2.1 Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines 6.2.2 Cold rolled grain-oriented steels for transformer, non-oriented steels for rotating machine 6.2.3 Nickel-iron alloys 6.2.4 Soft Ferrites 6.3 Hard magnetic materials Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications Thermocouple, bimetals, leads soldering and fuses material and their applications, thermistor, sensistor, varistors and their practical applications, Introduction to various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc	**10**

RECOMMENDED BOOKS

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
2. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi
3. Electrical Engineering Materials by Sahdev, Uneek International Publications, Jalandhar
4. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
5. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
6. Electrical and Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
7. Electrical and Electronics Engineering Materials DR Arora, Ishan Publications, Ambala City
8. Electrical Engineering Materials by Rakesh Dogra, SK Kataria and Sons, NEW Delhi
9. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.