Programme Structure

School of Polytechnic

Diploma in Electrical Engineering

Programme Code: SPB10

Batch: 2023-2026

Vision of the University

To be recognized as an Institution of excellence, facilitating learning, fostering creativity, knowledge creation, innovations, consultancy and leadership in multiple areas to build a conscious community that will positively impact living beings for a sustainable future.

Mission of the University

1. **Offers a wide range of Undergraduate and Post graduate Courses.**
   To create conducive environment for an interactive and application oriented experiential learning making the Institute a preferred destination for work and study.
2. **Research, Innovation, Consultancy & Entrepreneurial Culture**
   To Foster creativity, research and innovation orientation in students and faculty in basic and applied areas in all of its disciplines, provide cost effective solutions and nurture entrepreneurial capabilities to accelerate growth.
3. **Social Relevance with local actions on global thoughts**
   To act as a catalyst in social change by developing academic, social, political, technological, scientific, industrial and business leadership in the spirit "Think Globally and Act Locally"; by providing ample opportunities to develop team spirit, sportsmanship and love for culture and national heritage.

Core Values

Integrity
Leadership
Diversity
Community

Vision of the School of Polytechnic

To become a center of excellence for providing quality and value based education in the field of diploma engineering that will produce skilled technocrats to meet industry requirements.

Mission of the School of Polytechnic

- To provide technical knowledge and skills by using latest engineering tools.
- To facilitate industry-institute interaction to explore the industrial knowledge of the students.
- To inculcate ethical and professional values among students.
- To impart quality education to the students coming from rural parts and to conduct different curricular & co-curricular activities to enhance the academic.

Core Values

Integrity
Leadership
Diversity
Community

Programme Educational Objectives (PEO's)

PEO 1. To provide solid foundation in electrical engineering along with good communication and entrepreneurship skills for tackling social issues.

PEO 2. To impart students with good scientific and engineering knowledge in order to analyse, design and create novel products for giving practical solutions to real life problems.

PEO 3. To create engineers with sound technical knowledge for facing all sorts of challenges in industry or in pursuance of higher studies.

PEO 4. To motivate students, to acquire aptitude for lifelong learning along with leadership skills, team spirit and ethical values so that they upgrade themselves with the latest trends in the field of engineering in order to serve the society.

PROGRAMME OUTCOMES (POs)

PO 1. Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO 2. Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO 3. Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO 4. Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO 5. Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO 6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO 7. Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1. An ability to specify, design and analyse systems that efficiently generate, transmit, distribute and utilize electrical power.

PSO 2. An ability to analyse and design electrical machinery, electrical/electronic circuits, electrical/solid state drive systems, lighting systems and deliver technological solution by assimilating advances in allied disciplines.

PSO 3. An ability to specify, design, implement and test analog and embedded signal processing electronic systems using the state of the art components and software tools.

PSO 4. An ability to analyse, design and implement the learning in electrical instrumentation, control and automation applications.

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF ENGINEERING & TECHNOLOGY

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - I**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	DE-ASH-23101	*Applied Mathematics -1	3	0	0	3	3	50	50	100	45
2	DC	DE-ASH-23102	*Applied Physics-1	3	0	0	3	3	50	50	100	45
3	DC	DE-ASH-23103	*Applied Chemistry	3	0	0	3	3	50	50	100	45
4	AE	DE-ASH-23104	*Communication Skills H & E-I	2	0	0	2	2	50	50	100	45
5	OE	DE-ME-23106	*Engineering Drawing-I	0	0	4	4	2	50	50	100	45
6	DC	DE-ASH-23112	*Applied Physics-1 Lab	0	0	2	2	1	60	40	100	45
7	DC	DE-ASH-23113	*Applied Chemistry Lab	0	0	2	2	1	60	40	100	45
8	AE	DE-ASH-23114	*Communication Skills H & E -I Lab	0	0	2	2	1	60	40	100	45
9	SE	DE-ME-23116	*General Workshop Practice - I	0	0	4	4	2	60	40	100	45
10	SE	DE-CSE-23117	*Basics of Information Technology Lab	0	0	4	4	2	60	40	100	45
Total				11	0	18	29	20	550	450	1000	450

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF ENGINEERING & TECHNOLOGY

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - II**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	DE-ASH-23201	*Applied Mathematics -II	3	0	0	3	3	50	50	100	40
2	DC	DE-ASH-23202	*Applied Physics-II	3	0	0	3	3	50	50	100	40
3	DC	DE-EE-23203	Basic Electrical Engineering	3	0	0	3	3	50	50	100	40
4	DC	DE-ECE-23205	Analog Electronics	3	0	0	3	3	50	50	100	40
5	OE	DE-ME-23204	Basics of Mechanical and Civil Engineering	3	0	0	3	3	50	50	100	40
6	DC	DE-ASH-23212	*Applied Physics-II Lab	0	0	2	2	1	60	40	100	40
7	DC	DE-EE-23213	Basic Electrical Engineering Lab	0	0	2	2	1	60	40	100	40
8	DC	DE-ECE-23215	Analog Electronics Lab	0	0	2	2	1	60	40	100	40
9	OE	DE-ME-23214	Basics of Mechanical and Civil Engineering Lab	0	0	2	2	1	60	40	100	40
10	SE	DE-ME-23216	*General Workshop Practice - II	0	0	4	4	2	60	40	100	40
Total				15	0	12	27	21	550	450	1000	400

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF POLYTECHNIC

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - III**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	SPB10230301	Applied Mathematics -III	4	0	0	4	3	50	50	100	40
2	DC	SPB10230302	Electrical Instrumentation and Measurement	4	0	0	4	3	50	50	100	40
3	DC	SPB10230303	Electrical and Electronics Engineering Materials	4	0	0	4	3	50	50	100	40
4	DC	SPB10230304	Electrical Machine - I	4	0	0	4	3	50	50	100	40
5	OE	SPB10230305	Digital Electronics	3	0	0	3	2	50	50	100	40
6	VAC	SPB10230306	Environment Studies	2	0	0	2	2	50	50	100	40
7	DC	SPB10230352	Electrical Instrumentation and Measurement Lab	0	0	2	2	1	60	40	100	40
8	DC	SPB10230354	Electrical Machine - I Lab	0	0	2	2	1	60	40	100	40
9	OE	SPB10230355	Digital Electronics Lab	0	0	2	2	1	60	40	100	40
10	VAC	SPB10230356	Environment Studies Lab	0	0	2	2	1	60	40	100	40
Total				**21**	**0**	**8**	**29**	**20**	**540**	**460**	**1000**	**400**

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF POLYTECHNIC

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - IV**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	SPB10230401	Industrial Electronics and Control	4	0	0	4	2	50	50	100	40
2	DC	SPB10230402	Electrical Design, Drawing and Estimating-I	4	0	0	4	2	50	50	100	40
3	DC	SPB10230403	Power Plant Engineering	4	0	0	4	3	50	50	100	40
4	DC	SPB10230404	Transmission and Distribution of Electrical Power	4	0	0	4	3	50	50	100	40
5	AE	SPB10230405	Communication Skills H & E -II	2	0	0	2	2	50	50	100	40
6	VAC	SPB10230406	Energy Conservation	2	0	0	2	2	50	50	100	40
7	DC	SPB10230451	Industrial Electronics and Control Lab	0	0	2	2	1	60	40	100	40
8	DC	SPB10230452	Electrical Design, Drawing and Estimating-I Lab	0	0	2	2	1	60	40	100	40
9	AE	SPB10230455	Communication Skills H & E -II Lab	0	0	2	2	1	60	40	100	40
10	VAC	SPB10230456	Energy Conservation Lab	0	0	2	2	1	60	40	100	40
11	VAC	SPB10230457	*Universal Human Values	2	0	2	4	2	60	40	100	40
Total				22	0	10	32	20	600	500	1100	440

*Universal Human Values - Assessment will be done via practical exam only

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF POLYTECHNIC

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - V**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	SPB10230501	Switchgear and Protection	3	0	0	3	3	50	50	100	40
2	DC	SPB10230502	PLC, Microcontroller and SCADA	3	0	0	3	3	50	50	100	40
3	DC	SPB10230503	Electrical Machine – II	3	0	0	3	3	50	50	100	40
4	DE	SPB10230505/ SPB10230506/ SPB10230507	Elective: Renewable Sources of Energy Electric Traction Control of Electrical Machine	3	0	0	3	3	50	50	100	40
5	SE	SPB10230508	Industrial Management and Entrepreneurship Development	3	0	0	3	2	50	50	100	40
6	DC	SPB10230552	PLC, Microcontroller and SCADA Lab	0	0	2	2	1	60	40	100	40
7	DC	SPB10230553	Electrical Machine – II Lab	0	0	4	4	2	60	40	100	40
8	DC	SPB10230560	Summer Internship or Industrial training	0	0	0	0	3	0	100	100	40
Total				15	0	6	21	20	370	430	800	320

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF POLYTECHNIC

SCHEME OF STUDIES AND EVALUATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

Session- 2023-26 **Semester - VI**

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	DC	SPB10230601	Installation, Maintenance and Repair of Electrical Equipment	4	0	0	4	3	50	50	100	40
2	DC	SPB10230602	Electrical Design, Drawing and Estimating II	4	0	0	4	4	50	50	100	40
3	DC	SPB10230603	Utilization of Electrical Energy	4	0	0	4	4	50	50	100	40
4	DC	SPB10230651	Installation, Maintenance and Repair of Electrical Equipment lab	0	0	4	4	2	60	40	100	40
5	DC	SPB10230652	Electrical Design, Drawing and Estimating II lab	0	0	4	4	2	60	40	100	40
6	SE	SPB10230653	Application of Computer Software in Electrical Engineering Lab	0	0	4	4	2	60	40	100	40
7	DC	SPB10230663	Project Work	0	0	4	4	3	120	80	200	80
Total				12	0	16	28	20	450	350	800	320

Semester 1st

SCHOOL OF ENGINEERING & TECHNOLOGY

APPLIED MATHEMATICS - I

(DE-ASH-23101)

L	T	P
3	0	0

JUSTIFICATION

This course offers a fundamental understanding of elementary mathematics and its applications in engineering problem-solving. Students will learn to utilize key mathematical functions, including logarithms, partial fractions, matrices, as well as basic 2D geometry and curves. By mastering these concepts, students will gain the necessary skills to address engineering challenges across all disciplines effectively.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify arithmetic or geometric progressing series and Utilize Determinants and Cramer's Rule to solve systems of linear equations and analyse engineering problems that involve multiple variables, leading to efficient solutions in real-world scenarios.
2. Incorporate Vectors and Complex Numbers to address various engineering problems, allowing them to analyse AC circuits, control systems, and other phenomena that involve harmonic oscillations and phase shifts.
3. Apply trigonometric functions (sine, cosine, tangent, cosecant, secant, cotangent) and inverse trigonometric functions to model and analyse periodic phenomena, such as oscillations and waves, determining angles and distances in real-world applications like navigation, surveying, and control systems.
4. Apply differential calculus to analyse functions, identify their domains and ranges, and determine continuity and differentiability using elementary tests. They will apply various methods to find derivatives, including trigonometric, exponential, and logarithmic differentiation, as well as derivatives of inverse trigonometric and implicit functions.
5. Apply Higher Order differential calculus to find tangents, normals, points of maxima/minima, identify increasing/decreasing functions, and analyse rates, measures, velocity, acceleration, errors, and approximations in various engineering applications.

DETAILED CONTENTS

UNIT 1: Algebra **8 Periods**

1.1 Series : AP and GP; Sum, nth term, Mean

1.2 Matrices and Determinants : Matrix, Types and basic properties, Elementary properties of determinant of order 2 and 3, , Consistency of equation, Crammer's rule

UNIT 2: Algebra -II **8 Periods**

2.1 Complex number: Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations.

2.2 Addition and subtraction of Vectors, Resolution of vectors, Dot and Cross product of Vectors

UNIT 3: Trigonometry and Inverse Trigonometric Functions **10 Periods**

3.1 Trigonometric Functions and Identities.

3.2 Inverse Trigonometric functions : Simple case only

UNIT 4: Differential Calculus - I **16 Periods**

4.1 Functions, limits, continuity, functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.

UNIT 5: Differential Calculus - II **16 Periods**

5.1 Higher order derivatives, Simple applications.

5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration.

RECOMMENDED BOOKS

1. **Applied Mathematics-I** by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut
2. **Elementary Engineering Mathematics** by BS Grewal, Khanna Publishers, New Delhi
3. **Engineering Mathematics, Vol I & II** by SS Sastry, Prentice Hall of India Pvt. Ltd.,
4. **Applied Mathematics-I** by Chauhan and Chauhan, Krishna Publications, Meerut.

APPLIED PHYSICS-1

(DE-ASH-23102)

L	T	P
3	0	0

JUSTIFICATION

Physics is a field that explores various subjects relevant to our surroundings. It seeks to understand the natural world through observation and predicting how objects interact. The course emphasizes a strong understanding of physical laws and their practical applications in engineering and technology across different disciplines. Through this study, students gain insights into the behaviour of objects and their relevance in real-world scenarios.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Demonstrate a thorough understanding of fundamental and derived physical quantities, systems of units (FPS, CGS, SI), and conversion between different unit systems. They will be proficient in handling measurement errors, accuracy, and precision of instruments, along with representation and operations with scalar and vector quantities.
2. Analyse various forces and their effects on linear and circular motion. They will understand the principles of conservation of linear momentum and conservation of mechanical energy, applying them to real-world examples involving impulsive forces, circular motion, and work-energy transformations.
3. Demonstrate the concepts related to work, friction, power, and energy, along with their practical applications in various engineering scenarios. They will be able to analyse and solve problems involving these principles and apply them to real-world situations.
4. Demonstrate the concepts of translatory and rotational motions, torque, angular momentum, and moment of inertia. They will apply these principles in solving problems related to rotational kinetic energy, rolling motion, and the comparison of linear and rotational motion.
5. Demonstrate the concepts of elasticity, stress, strain, and different types of moduli of elasticity. They will apply Hooke's law and understand stress-strain curves. Additionally, they will learn about pressure, surface tension, viscosity, and fluid dynamics, including the application of Bernoulli's theorem and Reynold's number.

DETAILED CONTENTS

UNIT 1: Fundamentals of Units, Measurement, Errors and Vector Analysis **12 Periods**

1.1 Need of Measurement, physical Quantity - fundamental and derived, systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities. conversion of numerical values of physical quantities from one system of units into another

1.2 Error in measurement, accuracy and precision of instruments, percentage error, Combination of errors in addition, subtraction, multiplication, division and powers, rules for representing significant figures in calculation.

1.3 Scalar and vector quantities – examples, representation of vector, types of Vectors, Unit Vector, Vector Addition and Subtraction, Triangle and Parallelogram law (Statement only), difference between vector and scalar addition using examples, Scalar and Vector Product, Resolution of Vectors using the example of stationary object, falling object, moving object.

UNIT 2: Force and Motion **10 Periods**

2.1 Force, Momentum, Statement of Conservation of linear momentum, discuss using examples such as recoil of gun, Impulsive force and its examples,

2.2 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 (numerical practice) Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge, Application of various forces in lifts, cranes, large steam engines and turbines.

UNIT 3: Work, Power and Energy **10 Periods**

3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,

Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

3.2 Power and its units, calculation of power in numerical problems

3.3 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem, Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

UNIT 4: Rotational Motion and Gravitational Force **10 Periods**

4.1 Concept of translatory and rotatory motions with examples, Definition of torque with examples, Angular momentum, Conservation of angular momentum and its examples

4.2 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.

4.3 Rotational kinetic energy, Rolling of sphere on the slant plane, Comparison of linear motion and rotational motion, Application of rotational motions in transport vehicles, and machines

4.4 Gravitational force, Acceleration due gravity and its variation

UNIT 5: Properties of Matter & Thermodynamics **14 Periods**

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

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

5.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension

5.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.

5.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications

5.6 Difference between heat and temperature, Modes of transfer of heat (Conduction, convection and radiation with examples), Different scales of temperature and their relationship, Isothermal and Adibatic process, Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle, Application of various systems of thermometry in refrigeration and air-conditioning etc

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.
4. **Engineering Physics** by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. **Engineering Physics** by DK Bhhatacharya & Poonam Tandan; Oxford University Press.
6. **Modern Engineering Physics** by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
7. **Physics-I** by V. Rajendran, Tata McGraw-Hill raw Hill publication, New Delhi.

APPLIED CHEMESTRY

(DE-ASH-23103)

L	T	P
3	0	0

JUSTIFICATION

The use of various chemicals and chemical products in diverse technical and Engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

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

1. Classify various substances based on state of aggregation
2. Substantiate the laws and principles on which structure of atom is established.
3. Explain and predict properties of substances.
4. Explain sources of water and various characteristics of water (quantitatively).
5. Explain cause and factors which can adversely affecting natural water quality and remedial measures Available for water purification
6. Think critically, develop and adapt water conservation techniques.
7. Explain corrosion of metal and their preventive measures.
8. Explain chemical nature and causes of corrosion
9. Apply correct and efficient methods of corrosion prevention.
10. Explain chemistry of fuels and their relative advantages.
11. Select most efficient fuel for the engine and engineering applications.
12. Suggest how to subside air pollution caused by the use of fossil fuels
13. Explain the chemistry of various polymers and plastics
14. Verify suitability and select polymer/rubber/plastic materials for engineering applications.

DETAILED CONTENTS

UNIT 1: Atomic Model and Chemical Bonding **15 Periods**

1.1 Bohr's model of atom and successes and limitations of atomic theory (qualitative treatment only).

1.2 Atomic number, atomic mass number isotopes and isobars.

1.3 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance, Aufbau's principle, Pauli's exclusion principle and Hund's rule

1.4 Electronic configuration of elements with atomic number (Z) = 30 only. Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded),

1.5 Chemical bonding and cause of bonding.

UNIT 2: Fuels **10 Periods**

2.1 Definition of fuel, Calorific value-higher calorific value, lower calorific value, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels, Determination of calorific value fuel using Bomb calorimeter.

2.2 Coal - types of coal and proximate analysis of coal
Petroleum and its refining process, Fuel rating – Octane number and Cetane number.
Gaseous fuels like natural gas (CNG), LPG, producer gas, water gas and biogas, their calorific value and applications.
Elementary idea on – hydrogen as future fuels

UNIT 3: Water **15 Periods**

3.1 Demonstration of water resources on Earth using pie chart.
Classification of water – soft water and hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numerical.
Removal of hardness -Permutit process and Ion-exchange process.

3.2 pH and buffer solutions and their applications

3.3 Physico-Chemical methods for Water Quality Testing
a) Determination of pH using pH meter, total dissolved solids (TDS)
b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method (chemical reaction of EDTA method are excluded).
c) Understanding of Indian Water Quality standards as per WHO.

UNIT 4: Electrochemistry & Corossion **10 Periods**

4.1 Redox Reaction, Electrochemical cell (Galvanic and Electrolytic), application of electrochemistry – electroplating, galvanisation

4.2 Definition of corrosion and factors affecting corrosion rate.

4.3 Theories of a) Dry (chemical) corrosion & b) Wet corrosion in acidic atmospher Galvanic series,

4.4 Corrosion control: Internal corrosion preventive measures

UNIT 5: Organic compounds, Polymers and Plastics **10 Periods**

5.1 Classification of organic compounds and IUPAC Nomenclature

5.2 Functional Groups and IUPAC Nomenclature

5.3 Definition of polymer, monomer and degree of polymerization

5.4 Classification of addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite). Applications of polymers in industry and daily life .

5.5 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics

RECOMMENDED BOOKS

1. **Chemistry in Engineering** by J.C. Kuricose & J. Rajaram, Tata McGraw Hill,Publishing Company Limited, New Delhi.
2. **Engineering Chemistry** by P.C. Jain & Monika Jain, Dhanapat Rai PublishingCompany, New Delhi.
3. **Applied Chemistry** - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. **Engineering Chemistry** – A Text Book by H. K. Chopra & A. Parmar, NarosaPublishing House, New Delhi.
5. **Applied Chemistry** - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.

SCHOOL OF ENGINEERING & TECHNOLOGY

COMMUNICATION SKILLS H & E-I

(DE-ASH-23104)

L	T	P
2	0	0

JUSTIFICATION

Proficiency in the Hindi & English language plays a pivotal role in advancing one's career. This subject focuses on instilling fundamental principles of effective communication while prioritizing the cultivation of essential skills such as active listening, articulate speaking, proficient reading, and proficient writing as integral components of Communication Skills development.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify the building blocks of sentences (like nouns and verbs), and write sentences that make sense using the right words.
2. Understand the importance of communication well in life, both personally and professionally.
3. Identify how people share ideas, feelings, and information, and you'll be able to explain it to others.
4. Become proficient in reading and comprehending unseen passages. They will also have the ability to perform tasks such as one-word substitution, identifying prefixes and suffixes, and recognizing antonyms and synonyms based on the passages.
5. Read and understand new texts, and write different types of things like stories, announcements, and essays, using the right rules and style.

DETAILED CONTENTS

UNIT 1: Basics of Communication **8 Periods**

1.1 Definition and process of communication

1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal

1.3 Communications barriers and how to overcome them

1.4 Barriers to Communication, Tools of Communication

UNIT 2: Application of Grammar **8 Periods**

2.1 Parts of Speech (Noun, verb, adjective, adverb) and modals

2.2 Sentences and its types

2.3 Tenses

2.4 Active and Passive Voice

2.5 Punctuation

2.6 Direct and Indirect Speech

UNIT 3: English Reading Practices **10 Periods**

3.1 Reading unseen passage

3.2 Analyse language elements such as one-word substitutions, prefixes, suffixes, antonyms, synonyms, and more.

UNIT 4: English Reading & Writing Practices **10 Periods**

4.1 Writing practice: Summarizing short passages.

4.2 Introduction to formal letter writing.

4.3 Introduction to Notice writing.

UNIT 5: Hindi Reading & Writing Practices **16 Periods**

5.1 Writing practice: Summarizing short passages.

5.2 Introduction to formal letter writing.

5.3 Introduction to common Hindi idioms (Muhavare) and proverbs (Lokpriya Kahavatein)

5.4 Writing practice: Short essays on Hindi culture and literature.

5.5 Learning about famous Hindi writers, poets, Indian present and past personalities, and their works.

RECOMMENDED BOOKS

1. **Communicating Effectively in English, Book-I** by Revathi Srinivas; 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. **Communication Skills** – I by R Thakur, Nageen Prakashan Publication, Meerut, UP, India
5. **Excellent General English**-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
6. **The Functional aspects of Communication Skills** – Dr. P. Prsad, S.K. Katria & Sons, New Delhi

ENGINEERING DRAWING - I

(DE-ME-23106)

L	T	P
0	0	4

JUSTIFICATION

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, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

i) First angle projection is to be followed

ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD

iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
2. Draw free hand sketches of various kinds of objects.
3. Utilize various types of lines used in engineering drawing.
4. Read and apply different dimensioning methods on drawing of objects.
5. Use different types of scales and their utilization in reading and reproducing drawingsof objects and maps.
6. Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
7. Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
8. To make projections of Solid
9. Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
10. Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances

DETAILED CONTENTS

UNIT 1 Introduction to Engineering Drawing & Dimensioning Technique 6 Periods

1.1 Introduction to drawing instruments, materials, layout and sizes of drawing

1.2 Sheets and drawing boards.

1.3 Different types of lines in Engineering drawing as per BIS specifications

1.4 Practice of vertical, horizontal and inclined lines, geometrical figures such as

1.5 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)

1.6 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	
1.7	Scales –their needs and importance (theoretical instructions), type of scales,	
1.8	Definition of R.F. and length of scale	
UNIT 2	**English Reading & Writing Practices**	**6 Periods**
2.1	Theory of orthographic projections (Elaborate theoretical instructions)	
2.2	Projection of Points in different quadrant	
2.3	Projection of Straight Line (1st and 3rd angle) 4.3.1. Line parallel to both the planes 4.3.2. Line perpendicular to any one of the reference plane 4.3.3. Line inclined to any one of the reference plane.	
2.4	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	
2.5	Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)	
2.6	Identification of surfaces	
UNIT 3	**Projection of Solid**	**6 Periods**
3.1	Definition and salient features of Solid	
3.2	Types of Solid (Polyhedron and Solid of revolution)	
3.3	To make projections, sources, Top view, Front view and Side view of various types of Solid.	
3.4	Importance and salient features Sections	
3.5	Drawing of full section, half section, partial or broken out sections, Offset	
3.6	Sections, revolved sections and removed sections.	
3.7	Convention sectional representation of various materials, conventional breaks	
UNIT 4	**Isometric Views and Common Symbols used in Engineering**	**16 Periods**
4.1	Fundamentals of isometric projections and isometric scale.	
4.2	Isometric views of combination of regular solids like cylinder, cone, cube and	
4.3	Civil Engineering sanitary fitting symbols	
4.4	Electrical fitting symbols for domestic interior installations	
UNIT 5	**Basic of various commands in AutoCAD**	**2 Periods**
5.1	Basic introduction and operational instructions of various commands in utoCAD. 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.**	

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

SCHOOL OF ENGINEERING & TECHNOLOGY

APPLIED PHYSICS-I LAB

(DE-ASH-23112)

L	T	P
0	0	2

JUSTIFICATION

The diploma holder in Computer Science & Engineering needs to have hands-on knowledge of basic electrical measurements and electronic circuits, which they will encounter in their professional careers.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Demonstrate the use of high precision measuring callipers.
2. Demonstrate the laws of vector addition and subtraction.
3. Demonstrate the methods for the measurement of moment of inertia, acceleration due to gravity etc
4. Demonstrate the concepts of Stoke's Law and Hooke's Law.
5. Demonstrate the conservation of energy.

DETAILED CONTENTS

1	To find radius of wire and its volume and the maximum permissible error in these quantities by using both screw gauge.
2	To find diameter of metallic bob and use it to calculate its volume. Also Find the maximum permissible error in these quantities by using Vernier callipers.
3	To verify parallelogram law of vector addition and Subtraction.
4	To find the Moment of Inertia of a flywheel about its axis of rotation.
5	To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.
6	To study conservation of energy of a ball or cylinder rolling down an inclined plane.
7	To determine the viscosity of glycerin by Stoke's method
8	To determine force constant of spring using Hooks law
9	Simulation Practical-1
10	Simulation Practical-2

SCHOOL OF ENGINEERING & TECHNOLOGY

APPLIED CHEMISTRY LAB

(DE-ASH-23113)

L	T	P
0	0	2

JUSTIFICATION

The use of various chemicals and chemical products in diverse technical and Engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials.

DETAILED CONTENTS

1. Estimation of total hardness of water using standard EDTA solution
2. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution
3. Proximate analysis of solid fuel and liquid fuel
4. Estimation of temporary hardness of water sample by O' Hener's Method.
5. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus

RECOMMENDED BOOKS

1. **Chemistry in Engineering** by J.C. Kuricose & J. Rajaram, Tata McGraw Hill,Publishing Company Limited, New Delhi
2. **Engineering Chemistry** by P.C. Jain & Monika Jain, Dhanapat Rai PublishingCompany, New Delhi.
3. **Eagle' s Applied Chemistry** - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. **Engineering Chemistry** – A Text Book by H. K. Chopra & A. Parmar, NarosaPublishing House, New Delhi.
5. **Applied Chemistry** - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.

COMMUNICATION SKILL H & E-I LAB

(DE-ASH-23114)

L	T	P
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JUSTIFICATION

Proficiency in the Hindi & English language plays a pivotal role in advancing one's career. This subject focuses on instilling fundamental principles of effective communication while prioritizing the cultivation of essential skills such as active listening, articulate speaking, proficient reading, and proficient writing as integral components of Communication Skills development.

DETAILED CONTENTS

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.

RECOMMENDED BOOKS

1. **Communicating Effectively in English, Book-I** by Revathi Srinivas; 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. **Communication Skills** – I by R Thakur, Nageen Prakashan Publication, Meerut, UP, India
5. **Excellent General English**-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
6. **The Functional aspects of Communication Skills** – Dr. P. Prsad, S.K. Katria & Sons, New Delhi

GENERAL WORKSHOP PRACTICE -I

(DE-ME-23116)

L	T	P
0	0	4

JUSTIFICATION

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify tools and equipment used and their respective functions.
2. Identify different types of materials and their basic properties.
3. Use and take measurements with the help of basic measuring tools/equipment.
4. Select proper tools for a particular operation.
5. Select materials, tools, and sequence of operations to make a job as per given specification/drawing.

DETAILED CONTENTS

1. CARPENTRY SHOP

1.1 General Shop Talk

- Name and use of raw materials used in carpentry shop : wood & alternative materials
- Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.
- Specification of tools used in carpentry shop.
- Different types of Timbers, their properties, uses & defects.
- Seasoning of wood.

1.2 Practice

- Practices for Basic Carpentry Work
- Sawing practice using different types of saws
- Assembling jack plane – Planning practice including sharpening of jack plane cutter
- Chiselling practice using different types of chisels including sharpening of chisel

- Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.

1.3 **Job Practice**

- Job 1 Marking, sawing, planning and chiselling and their practice
- Job II Half Lap Joint (cross, L or T – any one)
- Job III Mortise and Tenon joint (T-Joint)
- Job IV Dove tail Joint (Lap or Bridle Joint)
- Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

2. **PAINTING AND POLISHING SHOP**

2.1 Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.

2.2 Job Practice

Job 1: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Job II: To prepare metal surface for painting, apply primer and paint the same.

Job III: To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

i) Abrasive cutting by leather wheel

ii) Polishing with hard cotton wheel and with polishing material

iii) Buffing with cotton wheel or buff wheel.

3. **ELECTRICAL SHOP**

3.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.

3.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.

3.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.

3.4 Introduction to the construction of lead acid battery and its working.

Job III Installation of battery and connecting two or three batteries in series and parallel.

3.5 Introduction to battery charger and its functioning.

Job IV Charging a battery and testing with hydrometer and cell tester

4. **WELDING SHOP**

4.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding

of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

4.2 Job Practice

- Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).
- Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).
- Job III Preparation of lap joint using arc welding process.
- Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

5. **PLUMBING SHOP**

5.1 Use of personal protective equipment, safety precautions while working and leaning of shop.

5.2 Introduction and demonstration of tools, equipment and machines used in plumbing shop.

5.3 Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.

5.4 Job Practice

- Job 1 : Preparation of job using elbow, bend and nipple
- Job II: Preparation of job using Union, Tap, Plug and Socket.
- Job III: Threading practice on pipe with die

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media
2. Promoters and Publishers Pvt. Ltd. Mumbai.
3. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House,Jalandhar.
4. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
5. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., NewDelhi
6. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi

SCHOOL OF ENGINEERING & TECHNOLOGY

BASIC OF INFORMATION TECHNOLOGY LAB

(DE-CSE-23117)

L	T	P
0	0	4

JUSTIFICATION

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.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify Computer Hardware Components, Network Components and Peripherals.
2. Explain the role of an Operating System.
3. Install System and Application Software.
4. Explain the function of the system components including Processor, Motherboard and Input-output devices.
5. Use Word Processing Software to prepare document.
6. Use Spreadsheet Software to create workbooks and automate calculation.
7. Use Presentation Software to create interactive presentation.
8. Perform fundamental tasks common to most application software including print, scan,save, edit, cut, copy, paste, format, spell and grammar check.
9. Use online office tools(Google suits)
10. Install Antivirus.

DETAILED CONTENTS

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

a) File Management: Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file

b) Page set up: Setting margins, tab setting, ruler, indenting

c) Editing a document: Entering text, cut, copy, paste using tool- bars

d) Formatting a document: Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods, Aligning of text in a document, justification of document, inserting bullets and numbering Formatting paragraph, inserting page breaks and column breaks, line spacing, Use of headers, footers: Inserting footnote, end note, use of comments, autotext, Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders: Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table, Print preview, zoom, page set up, printing options Using find, replace options

f) Using Tools like: Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and lables, Using shapes and drawing toolbar, Working with more than one window.

10. Spread Sheet Processing (MS Office/Open Office/Libre Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

b) Menu commands: Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

c) Work books: Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

d) Creating a chart: Working with chart types, changing data in chart, formatting a chart, use chart to analyze data, Using a list to organize data, sorting and filtering data in list

e) Retrieve data with query: Create a pivot table, customizing a pivot table. Statistical analysis of data

f) Exchange data with other application: Embedding objects, linking to other applications, import, export document.

11. PowerPoint Presentation (MS Office/Open Office/Libre office)

a) Introduction to PowerPoint: How to start PowerPoint, Working environment: concept of toolbars, slide layout & templates, Opening a new/existing presentation Different views for viewing slides in a presentation: normal, slide sorter.

b) Addition, deletion and saving of slides

c) Insertion of multimedia elements

Adding text boxes, Adding/importing pictures, Adding movies and sound. Adding tables and charts etc. , Adding organizational chart Editing objects, Working with Clip Art

d) Formatting slides

Using slide master, Text formatting, Changing slide layout, Changing slide colour scheme, Changing background, Applying design template

12. Google Suits Using Google drive, Google shut, Google docs, Google slides

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. Fundamentals of Information Technology **by Vipin Arora, Eagle Parkashan, Jalandhar**
4. Computer Fundamentals **by PK Sinha; BPB Publication, New Delhi**

Semester 2nd

APPLIED MATHEMATICS - II

(DE-ASH-23201)

L	T	P
3	0	0

JUSTIFICATION

Basic elements of integral calculus, differential calculus, numerical methods, differential m equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Calculate simple integration by methods of integration
2. Evaluate the area under curves, surface by using definite integrals.
3. Calculate the area and volume under a curve along areas.
4. Solve the engineering problems with numerical methods.
5. Understand the geometric shapes used in engineering problems by co-ordinate geometry.

DETAILED CONTENTS

UNIT 1: Integral Calculus-I — 12 Periods

Method of Indefinite Integration: Integration by substitution, Integration by rational function, Integration by partial fraction, Integration by Parts, Integration of special function

UNIT 2: Integral Calculus -II — 10 Periods

Meaning and properties of definite integrals, Evaluation of definite integrals, Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.

UNIT 3: Numerical Iteration Methods — 10 Periods

Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

UNIT 4: Co-ordinate Geometry (2 Dimension) — 11 Periods

Circle, Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

UNIT 5: Co-ordinate Geometry (3 Dimension) — 12 Periods

Straight lines and planes in space Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

RECOMMENDED BOOKS

1. Applied Mathematics-II **by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut**
2. Elementary Engineering Mathematics **by BS Grewal, Khanna Publishers, New Delhi**
3. Engineering Mathematics**, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.**
4. Applied Mathematics-II **by Chauhan and Chauhan, Krishna Publications, Meerut.**

APPLIED PHYSICS-II

(DE-ASH-23202)

L	T	P
3	0	0

JUSTIFICATION

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.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
2. Define the terms: frequency, amplitude, wavelength, velocity of a wave.
3. Explain various Engineering, Medical and Industrial applications of Ultrasonics.
4. Apply acoustics principles to various types of buildings to get best sound effect.
5. Explain diffraction, interference, polarization.
6. 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
7. Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
8. Explain the concept of electric current, resistance and its measurement
9. 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
10. Explain Biot-Savart Law, Ampere's law, Lorenz Force.
11. State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
12. Explain operation of moving coil galvanometer, simple DC motor
13. 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.
14. Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

DETAILED CONTENTS

UNIT 1: WAVE MOTION AND ITS APPLICATIONS **12 periods**

1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application

1.2 Wave equation y = r sin ωt, phase, phase difference, principle of superposition of waves

1.3 Simple Harmonic Motion (SHM): definition and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., simple pendulum, concept of simple harmonic

1.4 Concepts of Pitch, Loudness, Echo , Ultrasonics

UNIT 2: WAVE OPTICS **6 Periods**

2.1 Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, Power of lens, magnification.

2.2 Two-Source Interference, Double-Slit interference, Interference due to thin films, Fresnel's biprism.

2.3 Diffraction, Single Slit diffraction, Intensity calculation etc

2.4 Polarization of electromagnetic waves, polarizing sheets, polarizing by Reflection (Brewser's law), Malus law, use of polariods.

UNIT 3: ELECTROSTATICS **12 Periods**

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

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

3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors.

3.4 Dielectric and its effect on capacitance.

3.5 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)

UNIT 4: Magneto Statics and Electromagnetism **12 Periods**

4.1 Magnet, Magnetic poles, Magnetic Lines of Force, Different magnetic lines patterns due to interaction of two magnets, Electromagnetism, Magnetic field due to a straight conductor, Magnetic field due to a loop, Magnetic field due to a solenoid, Flemings Left Hand Rule, force on a current carrying conductor

4.2 Faraday's law of Electromagnetic Induction, Lenz' law, Flemings Right hand rule.

4.3 Magnetization, Gauss' law for magnetism.

4.4 Types of magnetic materials. Dia, para and ferromagnetic materials with their properties, Application of electromagnetism in ac/dc motors and generators.

UNIT 5: Semiconductor physics **12 Periods**

5.1 Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode working and its V-I characteristics

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

5.3 Semiconductor transistor, pnp and npn (concepts only)

5.4 Application of semiconductor diodes (Zener, LED) and transistor as switch.

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.
4. **Engineering Physics** by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. **Engineering Physics** by DK Bhhatacharya & Poonam Tandan; Oxford University Press.
6. **Modern Engineering Physics** by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
7. **Physics-II** by V. Rajendran, Tata McGraw-Hill raw Hill publication, New Delhi.

BASIC ELECTRICAL ENGINEERING

(DE-EE-23203)

L	T	P
3	0	0

JUSTIFICATION

A diploma holder may be involved in various jobs ranging from preventive maintenance of electrical installation to fault location. In addition, he/she may be working in testing laboratories where he/she uses measuring instruments. To carry out these and similar jobs effectively, knowledge of basic concepts, principles and their applications is very essential. This course will enable the students to understand the basic concepts and principles of DC and AC fundamental, ac circuits, batteries, electromagnetic induction, voltage and current sources etc.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify and able to take readings on various electrical equipments(voltmeter, ammeter, CRO, wattmeter, multi-meter)
2. Determination of voltage-current relationship in a DC circuit under specific physical conditions
3. Measure resistance of an ammeter and a voltmeter.
4. Verify DC circuits (Thevenin, Nortons, Superposition theorem, Maximum Power Transfer Theorem)
5. Verify Kirchhoff's Current and Voltage Laws in a dc circuit
6. Find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance
7. Test a lead - acid storage battery
8. Measure power and power factor in a single phase R-.L-.C. Circuit and calculation of active and reactive powers in the circuit.

DETAILED CONTENTS

UNIT 1: DC Circuit & Analysis **12 Periods**

1.1 Definition of basic terms, such as current, EMF, Potential Difference (PD); Ohm's Law and its limitations; Factors affecting resistors and capacitors; simple problems on series and parallel combinations of resistors with their wattage considerations.

1.2 Application of Kirchhoff's current law and Kirchhoff's voltage law to simple circuits. Star − Delta connections and their conversion

1.3 Superposition principle, Maximum Power Transfer Theorem, Thevenin's theorem, Norton's theorem, application of network theorems in solving D.C. circuit problems.

1.4 Concept of voltage source, symbol and graphical representation characteristics of ideal and practical sources.

1.5 Concept of current sources, symbol, characteristics and graphical representation of ideal and practical current sources.

1.6 Inter Conversion of Voltage-Source and Current Source.

UNIT 2: Electro Magnetic Induction **08 Periods**

2.1 Concept of electro-magnetic field produced by flow of electric current, magnetic

circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit..

2.2 Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced e.m.f, simple numerical problems.

2.3 Concept of current growth, decay and time constant in an inductive (RL) circuit.

2.4 Energy stored in an inductor, series and parallel combination of inductors.

UNIT 3: Batteries **08 Periods**

3.1 Basic idea of primary and secondary cells.

3.2 Construction, working principle and applications of Lead-Acid, Nickel-Cadmium and Silver-Oxide batteries

3.3 Charging methods used for lead-acid battery (accumulator)

3.4 Care and maintenance of lead-acid battery.

3.5 Series and parallel connections of batteries

3.6 General idea of solar cells, solar panels and their applications

3.7 Introduction to maintenance free batteries

UNIT 4: AC Fundamentals **08 Periods**

4.1 Concept of alternating quantities

4.2 Difference between ac and dc. Various AC and DC waveforms.

4.3 Representation of sinusoidal quantities by phasor diagrams.

4.4 Equation of sinusoidal wave form for an alternating quantity.

4.5 Effect of alternating voltage applied to a pure resistance, pure inductance and pure capacitance.

4.6 Concept of inductive and capacitive reactance.

4.7 Alternating voltage applied to resistance and inductance in series.

4.8 Alternating voltage applied to resistance and capacitance in series.

4.9 Alternating voltage applied to resistance, inductance and capacitance in series

4.10 Power in pure resistance, inductance and capacitance, power in combined RLC circuits. Power factor, active and reactive power and their significance, definition and significance of power factor.

4.11 Introduction to series and parallel resonance and its conditions.

4.12 Definition of conductance, susceptance, admittance, impedance and their units

4.13 Introduction to polyphase a.c. systems, advantages of polyphase system over single phase system. Relations between line and phase value of voltages and currents for star and delta connections and their phasor diagram, power in polyphase circuits.

UNIT 5: Various Types of Power Plants **08 Periods**

Brief explanation of principle of power generation practices in thermal, hydro and nuclear power stations and their comparative study. A Visit to a nearby Power Station(s) may be organized for better understanding and exposure. Elementary block diagram of above mentioned power stations

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal, Tata Mc Graw-Hill Education Pvt Ltd., New Delhi.
2. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.
3. Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
4. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi.
5. Basic Electrical Engineering by Asfaque Husain, Jain Book Depot, New Delhi

BASICS OF MECHANICAL & CIVIL ENGINEERING

(DE-ME-23204)

L	T	P
3	0	0

JUSTIFICATION

Apart from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementary Mech. Engg. to impart some necessary knowledge and skill about mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical and civil technician is intermingled with either civil or mechanical engineering. As such the relevant basic topics of these disciplines are included in the content of the subject.

Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Apply Thermodynamics Laws..
2. Use of various energy sources.
3. Solve basics problems related to fuel and combustion.
4. Have an idea of loading on machine components.
5. Explain the application of different types of bearings.
6. Explain the uses of different types of gears and springs.
7. Explain the working principle of different lubrication systems

DETAILED CONTENTS

Unit 1 **Thermal Engineering**

1.1 **Sources of Energy**

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work. Zeroth law of Thermodynamics Basic ideas, conventional and nonconventional forms- Thermal, Hydel, Tidal, Wind, Solar, Biomass and Nuclear and their uses.

1.2 **Fuels & Combustion:**

Combustion of fuels- their higher and lower calorific values. Combustion quations for carbon, sulphur, hydrogen and their simple compounds. Calculation of minimum amount of air required for complete combustion. Combustion analysis mass basis and on volume basis. Concept of excess air in a boiler furnace combustion. Heat carried away by flue gases.

Idea of specific properties of liquid fuels such as detonation, knock resistance (cetane and octane numbers), viscosity, solidification point, flash point and flame point.

Unit 2 Machine Components

Brief idea of loading on machine components.

- Pins, Cottor and Knuckle Joints.
- Keys, Key ways and spline on the shaft.
- Shafts, Collars, Cranks, Eccentrics.
- Couplings and Clutches.
- Bearings-Plane, Bushed, Split-step, ball, Roller bearing, Journal bearing, Foot

step bearing, thrust bearing, collar bearing and Special type bearings and their applications.

- Gears- Different types of gears, gear trains and their use for transmission of motion. Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound and epicyclic gear trains and their use. Definition of pitch and pitch circle & module.
- Springs Compression, Tension, Helical springs,Torsion springs, Leaf and Laminated springs. Their use and material.

Unit 3 Lubrication

Different lubrication system for lubricating the components of machines. Principle of working of wet sump and dry sump system of lubrication. (Explain with simple line diagram). Selection of lubricant based on different application (Requirement with the help of manufacturer catalogue).

SECTION B : CIVIL ENGINEERING

Unit 4 Construction Materials and Foundations

4.1 Properties and uses of various construction materials such as stones, bricks, lime, content and timber with their properties, physical/field testing, elements of brick masonry.

4.2 Bearing capacity of soil and its importance.

4.3 Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines.

Unit 5 Concrete & RCC

5.1 Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete, placing and curing of concrete..

5.2 Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building.

RECOMMENDED BOOKS

1. Textbook of Concrete Technology 2nd Edition, by Kulkarni, PD Ghosh TK and Phull, YR; New Age International(P) Ltd, Publishers, New Delhi
2. Materials of Construction by Ghosh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Concrete Technology by J.Jha and Sinha; Khanna Publishers, Delhi
5. Building Construction by Jha and Sinha; Khanna Publishers, Delhi
6. Building Construction by Vairani and Chandola; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, New Delhi
8. Soil Mechanics and Foundation Engineering by SK Garg; Khanna Publishers, New.

ANALOG ELECTRONICS

(DE-ECE-23205)

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JUSTIFICATION

Knowledge of Electronic components & devices is quite essential for a student of electronic engineering diploma programme. With the knowledge of these active and passive components he will work successful in every field of the branch. Therefore a diploma student in electronics engineering must be equipped with the fundamental knowledge about electronic components, voltage and current source, semi-conductor diode, transistors and FET for successful handling of industrial problems.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Indentify and distinguish between active components (BJT, FET etc) and passive components (Resistor, Capacitor, inductor etc).
2. Understand voltage and current sources as well as their inter conversions.
3. Understand the working and application of semiconductor diode including half wave rectifier & Full wave rectifier.
4. Understand the working of BJT and hence able to design amplifier using it.
5. Compare various transistors biasing circuit and stabilize their operating points.
6. Understand the working of FET and hence able to design amplifier using it.
7. Compare BJJT, JFET, MOSFET & CMOS.

DETAILED CONTENTS

UNIT 1: Semiconductor Diodes **06 Periods**

1.1 PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism

1.2 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance

1.3 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), relation between DC output and AC input voltage, efficiency of rectifier

1.4 Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie (π) filters and their applications

1.5 Diode ratings/specifications

1.6 Various types of diodes such as zener diode, varactor diode, schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications

1.7 Zener diode and its characteristics

1.8 Use of zener diode for voltage stabilization

UNIT 2: Bi-polar Transistors **16 Periods**

2.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow (VDR).

2.2 Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations polyester, ceramic paper mica and electrolytic tantalum and solid aluminum types; construction details and testing, specifications, mutual comparison & typical Applications.

2.3 Construction, operation of Field Effect Transistor (FET), characteristics and applications of a N channel JFET and P channel JFET

2.4 Types, construction, operation, characteristics and applications of a MOSFET.

2.5 Comparison between BJT, JFET and MOSFET

UNIT 3: Transistor Biasing and Stabilization 06 Periods

3.1 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point.

3.2 Different biasing circuits, limitations, simple problems to calculate operating point in different biasing circuits. Use of Thevenin's theorem to determine operating point

3.3 Concept of h-parameters of a transistor

3.4 Use of data book to know the parameters of a given transistor

UNIT 4: Single-Stage Transistor Amplifiers 12 Periods

4.1 Single stage transistor amplifier circuit in CE configuration, function of each component

4.2 Working of single stage transistor amplifier, physical and graphical explanation, phase reversal

4.3 Concept of DC and AC load line

4.4 Voltage gain of single stage transistor amplifier using characteristics of the device

4.5 Concept of input and output impedance

4.6 AC equivalent circuit of single stage transistor amplifiers

4.7 Calculation of voltage gain using AC equivalent circuit

4.8 Frequency response of a single stage transistor amplifier

UNIT 5: Multi-Stage Transistor Amplifiers 12 Periods

5.1 Need of multi-stage transistor amplifiers − different types of couplings, their purpose and applications.

5.2 Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width

5.3 RC coupled two-stage amplifiers, circuit details, working, frequency response, applications

5.4 Loading effect in multistage amplifiers

5.5 Elementary idea about direct coupled amplifier, its limitations and applications

5.6 Transformer coupled amplifiers, its frequency response. Effect of co-efficient of coupling on frequency response. Applications of transformer coupled amplifiers

RECOMMENDED BOOKS

1. **Basic Electronics and Linear Circuit** by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. **Principles of Electrical and Electronics Engineering** by VK Mehta; S Chand and Co., New Delhi
3. **Electronics Devices and Circuits** by Millman and Halkias; McGraw Hill.
4. **Electronic Devices and Circuits** by Dharma Raj Cheruku and Battula Tirumala Krishna: Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92
5. **Basic Electronics** by JB Gupta, SK Kataria and Sons, New Delhi
6. **Electronics Devices and circuit** by Boylested, Tata McGraw Hill, New Delhi

APPLIED PHYSICS-II LAB

(DE-ASH-23112)

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DETAILED CONTENTS

1. To determine the velocity of sound with the help of resonance tube
2. To find the focal length of convex lens by displacement method.
3. To find the refractive index of the material of given prism using spectrometer
4. To find the wavelength of sodium light using Fresnel's biprism.
5. To verify laws of resistances in series and parallel combination
6. To verify ohm' s laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw hysteresis curve of a ferromagnetic material.
10. To draw characteristics of a pn junction diode and determine knee and break down voltages.
11. To find wave length of the laser beam.
12. To find numerical aperture of an optical fiber.

BASIC ELECTRICAL ENGINEERING LAB

(DE-EE-23213)

L	T	P
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DETAILED CONTENTS

1. Ohm's law verification.
2. To verify the laws of series and parallel connection of resistance
3. To verify the laws of series and parallel connection of capacitance
4. To verify Kirchhoff's laws.
5. To measure the resistance of an ammeter and a voltmeter and to conclude that ammeter has very low resistance whereas voltmeter has very high resistance.
6. To verify Thevenin's and maximum power transfer theorems.
7. To find the ratio of inductance values of a coil having air core and iron core respectively and thus see that by the introduction of magnetic material inside the coil, the induction value of coil is substantially increased.
8. To test a battery for charged and discharged condition and to make connections for it's charging.
9. To show that the range of an ammeter (dc and ac) and a voltmeter (dc and ac) can be extended with the use of shunts and multipliers
10. To convert the given galvanometer into voltmeter and an ammeter.

BASICS OF MECHANICAL AND CIVIL ENGINEERING LAB

(DE-ME-23214)

L	T	P
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DETAILED CONTENTS

1	Study and Sketch of Pins and Cotter
2	Study and Sketch of Keys and Key ways
3	Study and sketch of Couplings and Clutches
4	Study and Sketch of Bearings
5	Study and Sketch of Springs
6	Study of green energy
7	Testing of bricks a) Shape and size b) Soundness test c) Water absorption d) Crushing strength
8	Testing of concrete a) Slump test b) Compressive Strength of concrete cube
9	The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works.

ANALOG ELECTRONICS LAB

(DE-ECE-23215)

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DETAILED CONTENTS

1 Identification of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (Germanium, point contact, silicon low power, high power and switching diode).

2 Familiarization with lab instruments (Multi-meter/CRO), etc.

3 Testing of various passive and active components.

4 Plotting of forward V-1 characteristics for a point contact and P-N junction diode (Silicon & Germanium diode).

5 To Plot forward and reverse V-I characteristics for a zener diode.

6 Rectifier circuits using semiconductor diode, measurement of input and output voltage and plotting of input and output wave shapes.

i) Half wave rectifier

ii) Full wave rectifier (centre tapped and bridge rectifier circuits

7 To Plot wave shapes of a full wave rectifier with shunt capacitor, series inductor and filter circuit.

8 To Plot the input and output characteristics and calculation of parameters of a transistor in common base configuration

9 To Plot input and output characteristics and calculation of parameters of a transistor in common emitter configuration.

10 10. Transistor Biasing circuits

i) Measurement of operating point (Ic&Vce) for a fixed bias circuit.

ii) Potential divider biasing circuits.

(Measurement can be made by changing the transistor in the circuits by another of a same type number).

11 Plot the FET characteristics and determination of its parameters from these characteristics.

12 Measurement of voltage gain at 1 KHZ for different load resistance for a BJT amplifier circuit.

13 Measurement of voltage gain for a JFET amplifier circuit.

14 Measurement of voltage gain for a MOSFET amplifier circuit

GENERAL WORKSHOP PRACTICE –II

(DE-ME-23216)

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JUSTIFICATION

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Identify tools and equipment used and their respective functions.
2. Identify different types of materials and their basic properties.
3. Use and take measurements with the help of basic measuring tools/equipment.
4. Select proper tools for a particular operation.
5. Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
6. Prepare simple jobs independently and inspect the same.
7. Follow safety procedures and precautionary measures.
8. Use safety equipment and Personal Protection Equipment.

DETAILED CONTENTS

UNIT 1: FITTING SHOP **12 Periods**

Use of personal protective equipment and safety precautions while working.

Basic deburring processes.

Introduction to fitting shop tools, marking and measuring devices/equipment.

Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)

Identification of various steel sections (flat, angle, channel, bar etc.).

Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

Job Practice:

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of ± .25 mm.

Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping

Job IV Drilling and tapping practice on MS Flat.

UNIT 2: SHEET METAL SHOP **6 Periods**

Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

Introduction and demonstration of hand tools used in sheet metal shop.

Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.

Study of various types of nuts, bolts, rivets, screws etc.

Job Practice:

Job I: Shearing practice on a sheet using hand shears.

Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.

Job III: Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

UNIT 3: WELDING SHOP-I **12 Periods**

Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

Job Practice:

Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).

Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

UNIT 4: FOUNDRY SHOP **6 Periods**

Study of metal and non metals

Study and Sketch of the Foundry tools

Study and sketch of Cupola and pit furnace

To prepare green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)

Casting of non ferrous (lead or aluminium)

UNIT 5: MACHINE SHOP **12 Periods**

Study and sketch of lathe machine

Study and Sketch of grinders, milling machine, drilling machine and CNC machine.

Plain and step turning and knurling practice.

Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi

Semester 3rd

SCHOOL OF POLYTECHNIC

APPLIED MATHEMATICS –III

(SPB10230301)

L	T	P
4	0	0

JUSTIFICATION

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 undergoing 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 a 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 **10 Periods**

1.3 Algebra of Matrices, Inverse 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.

1.4 Elementry Row/Column Transformation Meaning and use in computing inverse and rank of a matrix.

1.5 Linear Dependence, Rank of a Matrix 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.

1.6 Eigen Pairs, Cayley-Hamilton Theorem Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof)and its verification, Use in finding inverse and powers of a matrix

UNIT 2: Differential Calculus **8 Periods**

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians

2.3 Vector Calculus Vector function, Introduction todouble and triple integral,differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives

UNIT 3: Differential Equation **12 Periods**

3.1 Formation, Order, Degree, Types, Solution Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order,

Degree of a differential equation, Linear, nonlinear equation.

3.2 First Order Equations Variable seperable, equations reducible to seperable forms, Homogeneous eqution, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions

3.3 Higher Order Linear Equation : Property of solution, Linear differential equation with constant coefficients (PI for X= eax , Sinax, Cosax, Xn , eaxV, XV

3.4 Simple Applications LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

UNIT 4: Integral Calculus-II **10 Periods**

4.1 Beta and Gamma Functions, Definition, Use, Relation between the two, their use in evaluating integrals

4.2 Fourier Series Fourier series of f(x),-n<x

4.3 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 **8 Periods**

5.1 Probability Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution Discrete and continuous distribution, Bionimal Distribution, Poisson distribution, Normal Distribution.

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/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ELECTRICAL INSTRUMENTATION AND MEASUREMENT

(SPB10230302)

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4	0	0

JUSTIFICATION

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.

LEARNING 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: 10 Periods

1.1 Concept of measurement and instruments

1.2 Concept of measurement of electrical quantities and instruments for their measurements, sources of error.

1.3 Types of electrical measuring instruments– indicating, integrating and recording type instruments

1.4 Essentials of indicating instruments – deflecting, controlling and damping torque.

Ammeters and Voltmeters (Moving coil and moving iron type)

1.5 Concept of ammeter and voltmeters and difference between them

1.6 Construction and working principles of moving Iron and moving coil instruments

1.7 Merits and demerits, sources of error and application of these instruments

UNIT 2: Wattmeter's (Dynamometer Type) & Energy meter 8 Periods

2.1 Construction, working principle, merits and demerits of dynamometer type wattmeter, Digital wattmeters.

2.2 Power Measurements in 3-phase circuits by two wattmeter method in balanced and unbalanced circuits and simple problems,

2.3 Three wattmeter method.

2.3 Induction Type: Construction, working principle, merits and demerits of single phase and three-phase energy meters

2.4 Errors and their compensation

2.5 Simple numerical problems

2.6 Construction and working principle of maximum demand indicators

2.7 Digital energy meter (diagram, construction and application)

Unit 3: Electronic Instruments: **8 Periods**

3.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO and its various controls. Applications of CRO.

3.2 Digital Multimeter

3.3 Study of LCR meters and their applications

Unit 4: Miscellaneous Measuring Instruments: **12 Periods**

4.1 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 synchro scope and phase sequence indicator, tong tester (Clamp-on meter)

4.2 Instrument Transformers: Construction, working and applications a) CT b) PT

4.3 Smart Metering System : 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)

UNIT5: Transducers **10 Periods**

5.1 Transducers : Introduction, Types of Transducers (1 phase,3 phase) Basic concept of pressure measurement, flow measurement, level measurement, displacement measurement using transducers

5.2 Measurement of Temperature: Different types of thermometers, thermocouple, resistance temperature detector and their construction, principle and working. Thermal Imager Camera (Concept)

RECOMMENDED BOOKS

1. Electrical Measurements and Measuring Instruments by SK Sahdev, Uneek International Publications, Jalandhar
2. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
3. Electric Instruments by D. Cooper
4. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
5. Electronics Instrumentation by Umesh Sinha, Satya Publication, New Delhi
6. Electrical Measurement and Measuring Instruments by JB Gupta, SK Kataria and Sons, New Delhi
7. Electrical Measurement and Measuring Instruments by ML Anand, SK Kataria and Sons, New Delhi

SCHOOL OF POLYTECHNIC

ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

(SPB10230303)

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JUSTIFICATION

A diploma holder in Electrical Engineering will be involved in maintenance, repair and production 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 in order 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.

LEARNING 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 particular electrical machine
- Select gaseous material for particular application

DETAILED CONTENTS

UNIT 1: Classification: **12 Periods**

1.1 Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands.

1.2 Conducting Materials: Introduction

1.3 Resistance and factors affecting it such as alloying and temperature etc.

1.4 Classification of conducting material as low resistivity and high resistivity materials, low resistance materials

1.5 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.

1.6 Aluminium: General properties as conductor: resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solder ability, contact resistance. Applications in the field of electrical engineering

1.7 Steel: Mechanical properties of steel, applications in the field of electrical engineering.

1.8 Introduction to bundle conductors and its applications.

1.9 Applications of special metals e.g. Silver, Gold, Platinum etc.

1.10 High resistivity materials and their applications e.g., manganin, constantan, Nichrome, mercury, platinum, carbon and tungsten

1.11 Superconductors and their applications

UNIT 2: Review of Semi-conducting Materials **4 Periods**

Semi-conductors and their properties, Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

UNIT 3: Insulating materials; General Properties: **12 Periods**

3.1 Electrical Properties: Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant

3.2	Physical Properties: Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness	
3.3	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	
3.4	Chemical Properties: Solubility, chemical resistance, weather ability	
3.5	Mechanical properties, mechanical structure, tensile structure.	
3.6	Plastics: Definition and classification,	
3.7	Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine-formaldehyde), epoxy resins - their important properties and applications	
3.8	Thermo-plastic materials: Polyvinyl chloride (PVC), polyethylene, silicones, their important properties and applications	
3.9	Natural insulating materials, properties and their applications	
3.10	Mica and Mica products - Asbestos and asbestos products - Ceramic materials (porcelain and steatite) - Glass and glass products - Cotton - Silk - Jute - Paper (dry and impregnated) - 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	
3.11	Gaseous materials; Air, Hydrogen, Nitrogen, SF-their properties and applications	
UNIT 4:	**Magnetic Materials:**	**12 Periods**
4.1	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.	
4.2	Soft Magnetic Materials: Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines	
4.3	Cold rolled grain oriented steels for transformer	
4.4	Non-oriented steels for rotating machine Nickel-iron alloys	
4.5	Soft Ferrites	
4.6	Hard magnetic materials Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications	
Unit 5:	**Special Materials:**	**8 Periods**
5.1	Thermocouple, bimetals, leads soldering and fuses material and their applications, thermistor, sensistor, varistors and their practical applications.	
5.2	Materials for Electrical Machines: Introduction to various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc.	

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/NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ELECTRICAL MACHINES - I

(SPB10230304)

L	T	P
4	0	0

JUSTIFICATION

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

LEARNING 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 **8 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

UNIT2: DC Machines **10 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
2.7 Losses in a DC machine
2.8 Determination of losses by Swinburne's test
2.9 Rating and Specifications of DC machines

UNIT3: DC Machines **10 Periods**

3.1 Armature Reaction
3.2 Methods to improve commutation
3.3 Performance and characteristics of different types of DC motors
3.4 Speed control of dc shunt/series motors
3.5 Need of starter, three point dc shunt motor starter and 4 point starter

3.6 Electric Braking
3.7 Applications of DC motors
3.8 Faults in dc machines and their retrospective

UNIT4: Single phase Machine **12 Periods**

4.1 Introduction
4.2 Constructional features of a transformer and parts of transformer
4.3 Working principle of a transformer
4.4 EMF equation
4.5 Transformer on no-load and its phasor diagram
4.6 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
4.7 Mutual and leakage fluxes, leakage reactance
4.8 Transformer on load, voltage drops and its phasor diagram
4.9 Equivalent circuit diagram
4.10 Relation between induced emf and terminal voltage, voltage regulation of a transformer- mathematical relation
4.11 Losses in a transformer
4.12 Open circuit and short circuit test. Calculation of efficiency, condition for maximum efficiency-maintenance of Transformer, scheduled Maintenance.
4.13 Auto transformer construction, working and applications
4.14 Different types of transformers including dry type transformer.
4.15 Rating and Specifications of single phase transformer

UNIT5: Three Phase Transformer **8 Periods**

5.1 Construction of three phase transformers and accessories of transformers such as Conservator breather, Buchholz Relay, Tap Changer (off load and on load) (Brief idea)
5.2 Types of three phase transformer i.e. delta-delta, delta-star, star-delta and star-star
5.3 Star delta connections (relationship between phase and line voltage, phase and line current)
5.4 Conditions for parallel operation (only conditions are to be studied)
5.5 On load tap changer
5.6 Difference between power and distribution transformer three phase transformers
5.7 Cooling of transformer
5.8 Rating and Specifications of three phase transformers.

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/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

DIGITAL ELECTRONICS

(SPB10230305)

L	T	P
3	0	0

JUSTIFICATION

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belong to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Add, multiply; subtract binary to hexa decimal number system
- Use 1's and 2's compliment method for addition and subtraction
- Draw the symbols of various gates and write the truth tables for those gates
- Use Boolean laws for the simplification of logical expressions
- Use the de-Morgan's theorem for simplification
- Apply K-map technique for simplifications
- Apply half adder, full adder, encoder, decoder, multiplexer and demultiplexer.
- Use various flip-flops in digital circuits
- Use converted from A/D and D/A conversions
- Use various types of numbers in digital circuits

DETAILED CONTENTS

UNIT 1: Number Systems **12 Periods**

1.5 Decimal, binary, octal and hexa-decimal number systems and their interconversion

1.6 Binary and Hexadecimal addition, subtraction and multiplication

1.7 1's and 2's complement methods of addition/subtraction

1.8 **Gates:** Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR exclusive-AND gates.

1.9 **Boolean Algebra: Boolean** Relations and their applications, De-Morgan's Theorems, K-Map upto four variables.

UNIT 2: Combinational Circuits **10 Periods**

2.1 Half adder, Full adder

2.2 Encoder, Decoder

2.3 Multiplexer/Demultiplexer

2.4 Display Devices (LED, LCD and 7-segment display)

UNIT 3: Flip-Flops : **10 Periods**

3.1 J-K Flip-Flop

3.2 R-S Flip-Flop

3.3 D Type flip flop

3.4 T-Type Flip-Flop

3.5 Applications of Flip-Flops

3.6 Introduction of Shift Registers and Counters

UNIT 4: A/D and D/A Converters **8 Periods**

4.1 A/D and D/A Converters

4.2 A/D converter (Counter ramp, successive approximation method of A/D Conversion)
4.3 D/A converters (Binary weighted, R-2R D/A Converter)

UNIT 5: Semi-conductor Memories **8 Periods**

5.1 Types of semi-conductor memories: RAM, ROM, EPROM, EEPROM
5.2 Static and dynamic RAM
5.3 Merits, demerits, and applications.

RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain, Tata McGraw Hill, Education Pvt. Ltd. New Delhi
2. Digital Principles and Electronics by Malvino and Leach, Tata McGraw Hill, New Delhi
3. Digital Electronics by SN Ali
4. Digital Electronics by Rajive Sapra, Eshan Publications, Ambala City
5. Digital Fundamentals by Floyd and Jain , Pearsons Education (Singapore) Pte Ltd Patparganj, Delhi 110092
6. Digital Electronics by Jamwal, Dhanpat Rai and Co. New Delhi
7. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ENVIRONMENT STUDIES

(SPB10230306)

L	T	P
2	0	0

JUSTIFICATION

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 — **8 Periods**

1.1 Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non-renewable.

1.2 **Air Pollution:** Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

UNIT2: Water Pollution: — **8 Periods**

2.1 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

UNIT3: Soil Pollution — **6 Periods**

3.1 Sources of soil pollution

3.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste

3.3 Effect of Solid waste

3.4 Disposal of Solid Waste- Solid Waste Management

UNIT4: Noise pollution — **8 Periods**

4.1 **Noise pollution:** Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

4.2 **Environmental Legislation:** Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (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).

UNIT5: Impact of Energy Usage on Environment: **6 Periods**

5.1 Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

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
3. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
4. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
6. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ELECTRICAL INSTRUMENTATION LAB

(SPB10230352)

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JUSTIFICATION

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.

LEARNING 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

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 power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
4. Measurement of power and power factor of a three-phase balanced load by two wattmeter method.
5. Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.
6. Use of LCR meter for measuring inductance, capacitance and resistance.
7. To record all electrical quantities from the meters installed in the institution premises.
8. To measure Energy at different Loads using Single Phase Digital Energy meter.
9. Measurement of temperature by using thermistor/Thermal Imager
10. Calibration of single phase and three-phase energy meter and digital energy meter.

SCHOOL OF POLYTECHNIC

ELECTRICAL MACHINE -I LAB

(SPB10230354)

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JUSTIFICATION

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.

LEARNING 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

1. 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.

SCHOOL OF POLYTECHNIC

DIGITAL ELECTRONICS LAB

(SPB10230355)

L	T	P
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JUSTIFICATION

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belong to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Add, multiply, subtract binary to hexa decimal number system
- Use 1's and 2's compliment method for addition and subtraction
- Draw the symbols of various gates and write the truth tables for those gates
- Use boolean laws for the simplification of logical expressions
- Use the de-morgan's theorem for simplification
- Apply K-map technique for simplifications
- Apply half adder, full adder, encoder, decoder, multiplexer and demultiplexer
- Use various flip-flops in digital circuits
- Use converted from A/D and D/A conversions
- Use various types of numbers in digital circuits

DETAILED CONTENTS

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates
2. Construction of Half Adder using gates
3. Construction of Full Adder using gates
4. To verify the truth table for JK flip-flop
5. Construction and testing of any counter
6. Verification of operation of a 8-bit D/A Converter

ENVIRONMENTAL STUDIES

(SPB10230356)

L	T	P
0	0	2

JUSTIFICATION

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, students 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

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 alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil

Semester 4th

SCHOOL OF POLYTECHNIC

INDUSTRIAL ELECTRONICS AND CONTROL

(SPB10230401)

L	T	P
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JUSTIFICATION

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.

LEARNING 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 **12 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, 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 **10 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

UNIT-3 Inverters, Choppers, Dual Converters and Cyclo Convertors **10 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

UNIT-4 Thyristor Control of Electric Drives **10 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

UNIT-5 Uninterrupted power supplies **6 Periods**

5.1 UPS online, off line
5.2 Storage devices (batteries)
5.3 SMPS, CVT

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/ NITTTR, Chandigarh

SCHOOL OF POLYTECHNIC

ELECTRICAL DESIGN, DRAWING AND ESTIMATING -I

(SPB10230402)

L	T	P
4	0	0

JUSTIFICATION

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 content of this subject has been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering.

LEARNING 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 **8 Periods**

1.1 Various Electrical Symbols used in Domestic and Industrial Installation and Power System (Generation, Transmission and Distribution including Sub-stations) as per BIS Code.

1.2 **WIRING DIAGRAM**: Wiring diagram of light, fan, bell and alarm circuits

1.3 Staircase and godown wiring

1.4 Traffic light signal control circuit at crossroads

UNIT-2 Panels/Distribution Boards **12 Periods**

2.1 Design and Drawing of panels/Distribution board using MCB, ELCB main switches and change over switches for domestic installation, industrial and commercial installation.

2.2 **Orthographic projections of Simple Electrical Parts** :Bus bar post/ Kit Kat 11kV/66kV)

2.3 Pin type and shackle type insulator (Pin Type 11kV/66kV)

2.4 Bobbins of a small transformer / choke

2.5 Stay insulators/Suspension type insulators

2.6 Rotor of a squirrel cage induction motor

2.7 Motor body (induction motor) as per IS Specifications (using outside dimensions)

2.8 Slip rings of 3-phase induction Motor.

2.9 Stator of 3 phase Induction motor (Sectional View)

2.10 Prepare atleast 2 wiring diagram and block diagrams for circuits/systems using any Engineering Graphic package (preferably CAD)

UNIT 3 Types of Wiring **6 Periods**

3.1 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**)**

UNIT 4 Introduction to Estimating & Costing **12 Periods**

4.1 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.

4.2 Domestic installations; standard practice as per IS and IE rules. Planning of circuits, sub-circuits and position of different accessories, electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (single storey and multi-storey buildings having similar electrical load)

4.3 Industrial installations; relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of list of materials, estimating and costing exercises on workshop with singe-phase, 3-phase motor load and the light load (3-phase supply system)

4.4 Service line connections estimate for domestic and industrial loads (over-head and underground connections) from pole to energy meter**.**

UNIT-5 Estimating Materials Required **10 Periods**

5.1 Transmission and distribution lines (overhead and underground) planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations

5.2 Substation: Types of substations, substation schemes and components, estimate of 11/0.4 kV pole mounted substation up to 200 kVA rating, earthling of substations, single Diagram of 66 kV/11 kV, 132KV/11KV, 220KV/33KV Substation

5.3 Single line diagram, layout sketching of outdoor, indoor 11kV sub-station or 33kV sub-station

5.4 **Preparation of Tender Documents** Tender – constituents, finalization, specimen tender. Procedure to take financial loans from banks for taking contracts.

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/ NITTTR, Chandigarh

SCHOOL OF POLYTECHNIC

POWER PLANT ENGINEERING

(SPB10230403)

L	T	P
4	0	0

JUSTIFICATION

The majority of the diploma passouts 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.

LEARNING 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 **4 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.

UNIT-2 Thermal Station & Nuclear Power Plant **12 Periods**

2.1 Thermal Station Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water, choice of pressure of steam generation and steam temperature, selection of appropriate vacuum; economizer, air pre-heater feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant heat balance and efficiency.

2.2 Elements of Nuclear Power Plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.

UNIT-3 Hydro-Electric Plant, Diesel Power Plant & Gas Turbine Plant **12 Periods**

3.1 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.

3.2 Diesel engine performance and operation, Plant layout, Log sheets, applications, selection of engine size.

3.3 **Gas Turbine Plant:** Plant layout, methods of improving output and performance. Fuels and fuel systems. Methods of testing. Open and closed cycle plants. Operating characteristics. Applications. Free piston engine plants, limitation and applications. Non-conventional energy sources.

UNIT 4 Economics of Generation **8 Periods**

4.1 Fixed and running cost, load estimation, load curves, demand factor, load factor, diversity factor, power factor and their effect on cost of generation, simple problems.

4.2 Base load and peak load power stations, concept of regional and national grid, reason of grid failure and its remedies.

UNIT-5 Combined Working of Power Plant **12 Periods**

5.1 Advantages of combined working of different types of power plants. Need for coordination of various types of power plants in power systems, base load stations and peak load stations.

5.2 **Non-Conventional Source of Energy:** 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
2. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
3. Electrical Power System by VK Mehta, S Chand and Co., New Delhi
4. Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi
5. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
6. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
7. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi
8. Electrical Power by Soni Gupta and Bhatnagar; Dhanpat Rai & Sons, New Delhi
9. e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

(SPB10230404)

L	T	P
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JUSTIFICATION

The majority of the diploma passouts 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.

LEARNING 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 **14 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

1.7 Economic Principle of Transmission Kelvin's law, limitation of Kelvin's law modification in Kelvin's law

UNIT-2 Distribution System **10 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 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

UNIT-3 Substations: 8 Periods

3.1 Brief idea about substations; outdoor 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.

UNIT 4 Power Factor: 8 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)

UNIT-5 Revenue and Energy loss 8 Periods

5.1 Technical losses and Commercial losses, Input energy calculation, Sales calculation, Billing efficiency, Collection efficiency, Total energy billed (KWH), Percent aggregated technical and commercial losses

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/ NITTTR, Chandigarh

SCHOOL OF POLYTECHNIC

COMMUNICATION SKILLS H & E -II

(SPB10230405)

L	T	P
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JUSTIFICATION

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.

LEARNING 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 organised set up and social context.

DETAILED CONTENTS

UNIT-1 Functional Grammar **8 Periods**

1.1 Prepositions
1.2 Framing Questions
1.3 Conjunctions
1.4 Tenses

UNIT-2 Reading **8 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.

UNIT-3 Writing Skill-1 **8 Periods**

3.1 Correspondence a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters. b) Official Letters- Letters to Government and other Offices

UNIT-4 Writing Skill-2 & Report Writing **4 Periods**

4.1 Memos, Circular, Office Orders
4.2 Agenda & Minutes of Meeting
4.3 Report Writing Format

UNIT-5 Hindi Speaking & Writing Practices **4 Periods**

5.1 Business Letter in hindi
5.2 Report Writing in hindi
5.3 Essays on Famous Indian personalities
5.4 Hindi Speaking

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; 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/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ENERGY CONSERVATION

(SPB10230406)

L	T	P
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JUSTIFICATION

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 equipment.
- 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 of Energy **12 Periods**

1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.

1.2 Global fuel reserve

1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)

1.4 Impact of energy usage on climate

1.5 **Energy Conservation and EC Act 2001:** Introduction to energy management, energy conservation, energy efficiency and its need

1.6 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.

1.7 Standards and Labelling: Concept of star rating and its importance, Types of product available for star rating

UNIT-2 Electrical Supply System and Motors **10 Periods**

2.1 Types of electrical supply system

2.2 Single line diagram

2.3 Losses in electrical power distribution system

2.4 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)

2.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers

2.6 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 mot

2.7 **Lighting Systems**: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting

2.8 **DG Systems:** Introduction, Energy efficiency opportunities in DG systems, Loading estimation

UNIT-3 Energy Efficiency in Electrical Utilities **10 Periods**

3.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps

3.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.

3.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

3.4 **Energy Efficiency in Thermal Utilities** Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

3.5 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

3.6 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers

3.7 Efficient Steam Utilization

UNIT 4 Energy Conservation Building Code (ECBC) **8 Periods**

4.1 ECBC and its salient features

4.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

4.3 **Waste Heat Recovery and Co-Generation**: Concept, classification and benefits of waste heat recovery

4.4 Concept and types of co-generation system

UNIT-5 General Energy Saving Tips Energy saving tips in: **8 Periods**

5.1 Lighting, Room Air Conditioner ,Refrigerator , Water Heater , Computer, Fan, Heater, Blower and Washing Machine, Colour Television , Water Pump , Cooking ,Transport

5.2 **Energy Audit:** Types and methodology , Energy audit instruments , Energy auditing reporting format

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. 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

SCHOOL OF POLYTECHNIC

INDUSTRIAL ELECTRONICS AND CONTROL LAB

(SPB10230451)

L	T	P
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JUSTIFICATION

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.

LEARNING 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

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 DIAC
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

SCHOOL OF POLYTECHNIC

ELECTRICAL DESIGN, DRAWING AND ESTIMATION –I LAB

(SPB10230452)

L	T	P
0	0	2

JUSTIFICATION

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

LEARNING 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

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.

SCHOOL OF POLYTECHNIC

COMMUNICATION SKILLS H & E -II LAB

(SPB10230455)

L	T	P
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JUSTIFICATION

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.

LEARNING OUTCOMES

After completing this course, students will be able to:

1. Frame correct sentences with illustrations
2. Comprehend the language correctly
3. Interpret the language correctly
4. Use given material in new situations.
5. Correspond effectively using various types of writings like letters, memos etc.
6. 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

1	Debate
2	Telephonic Conversation: general etiquette for making and receiving calls
3	Offering- Responding to offers.
4	Requesting – Responding to requests
5	Congratulating
6	Exploring sympathy and condolences
7	Asking Questions- Polite Responses
8	Apologizing, forgiving
9	Complaining
10	Warning
11	Asking and giving information
12	Getting and giving permission
13	Asking for and giving opinions

SCHOOL OF POLYTECHNIC

ENERGY CONSERVATION LAB

(SPB10230456)

L	T	P
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JUSTIFICATION

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 equipment.
- 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

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 consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor
6. To measure the effect of blower speed on energy consumed by it.

SCHOOL OF POLYTECHNIC

UNIVERSAL HUMAN VALUES

(SPB10230457)

L	T	P
2	0	2

JUSTIFICATION

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. 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. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

DETAILED CONTENTS

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education **08 Periods**

1.1 Understanding the need, basic guidelines, content and process for Value Education

1.2 Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration

1.3 Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority

1.4 Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

UNIT2: Understanding Harmony in the Human Being - Harmony in Myself! **08 Periods**

2.1 Understanding human being as a co-existence of the sentient 'I' and the material the Body'

2.2 Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha

2.3 Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).

2.4 Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship **08 Periods**

3.1 Understanding Harmony in the family – the basic unit of human interaction

3.2 Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; a. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship

3.3 Understanding the meaning of Vishwas; Difference between intention and competence

3.4 Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship

3.5 Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals

3.6 Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj)

UNIT4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence **08 Periods**

4.1 Understanding the harmony in the Nature

4.2 Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature

4.3 Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space

4.4 Holistic perception of harmony at all levels of existence

UNIT5: Implications of the above Holistic Understanding of Harmony on Professional Ethics **06 Periods**

5.1 Natural acceptance of human values

5.2 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

5.3 Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations

5.4 To inculcate Human Values among Students: The Role of self ,Parents and Teachers

5.5 Practical Session also Includes Different Yogic Exercises and Meditation Session

RECOMMENDED BOOKS

1. Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, an Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology–the Untold Story
6. Case study Hevade Bazar Movie
7. Universal Human Values by Ankit Kumar, J.N.P Meerut.

Semester 5th

SCHOOL OF POLYTECHNIC

SWITCHGEAR AND PROTECTION

(SPB10230501)

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JUSTIFICATION

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma pass outs 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.

LEARNING 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**	**8 Periods**
1.1	Types of faults, three phase symmetrical faults, effects of faults on system reliability and stability, abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams	
UNIT2:	**Switchgear**	**12 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, classification, rating of circuit breakers, working of different types of air and oil circuit breakers, specification of circuit breakers, maintenance schedule, SF6 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.	
UNIT3:	**Protective Schemes**	**10 Periods**
3.1	Protection of alternators, stator faults, and 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 protective 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.

UNIT4: Protection Against Over Voltages **8 Periods**

4.1 Causes of over voltages, travelling wave's earth wire, protective zone, lightening arrestors, space-gap and electrolytic arrestors, surge absorber, location and rating of lightening arrestors. Thyrite lightening arrestor

UNIT5: Different Type of Sub-stations **10 Periods**

5.1 Layout, single line diagram, busbar arrangement, equipment, their functions, accessories, study of protective schemes, batteries and their maintenance, operation of small sub-stations.

5.2 5.2 Reactors: types of reactors, busbar reactor, tuning reactor, arc-suppression reactor, connection of reactors in power stations, uses of reactors.

5.3 Neutral grounding:- 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)

RECOMMENDED BOOKS

1. Switchgear and Protection by Nagrath Kathan; 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 Harnoon Asfaq Hussain; Khanna Publications
5. Switchgear and Protection by J.B. Gupta; Kataria & Sons

SCHOOL OF POLYTECHNIC

PLC, MICROCONTROLLER & SCADA

(SPB10230502)

L	T	P
3	0	0

JUSTIFICATION

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**	**8 Periods**
1.1	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	
UNIT2:	**Instruction Set**	**10 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	Ladder Diagram Programming: programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.	
UNIT3:	**Microcontroller series (MCS)-51 over view**	**10 Periods**
3.1	Pin details, I/O ports structure, memory organisation, special function registers instruction set, addressing modes, timers operation, serial port operation, interrupts.	
UNIT4:	**Assembly language programming**	**8 Periods**
4.1	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.	
UNIT5:	**SCADA**	**8 Periods**
5.1	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.	

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, Pen ram International
4. Power system SCADA and smart Grids by Mini S. Thomas and John D. McDonald

SCHOOL OF POLYTECHNIC

ELECTRICAL MACHINE II

(SPB10230503)

L	T	P
3	0	0

JUSTIFICATION

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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

UNIT 1:	**3 Phase Induction Motors-1**	**10 Periods**
1.1	Production of rotating magnetic field in 3 phases 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 motor	
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	
UNIT 2:	**3 Phase Induction Motors-2**	**8 Periods**
2.1	Double cage rotor motor and its applications	
2.2	Starting of 3-phase induction motors, DOL, star-delta, auto transformer starter.	
2.3	Causes of low power factor of induction motors	
2.4	Testing of 3-phase motor on no load and blocked rotor test and to find efficiency	
2.5	Method of Speed control of induction motor	
2.6	Harmonics and its effects, cogging and crawling in Induction Motors.	
2.7	Specifications and ratings of induction motors.	

UNIT3:	**Single Phase Motors**	**12 Periods**
3.1	Single phase induction motors; Construction characteristics, specifications and applications.	
3.2	Nature of field produced in single phase induction motor-double revolving field theory.	
3.3	**Split phase induction motor:** 1) Capacitor start, capacitor run, capacitor start and run motor 2) Shaded pole motor	
3.4	Alternating current series motor and universal motors, construction, working principle and operation, application	
3.5	**Single phase synchronous motor** :1) Reluctance motor 2) Hysteresis motor	
UNIT4:	**Synchronous Machines**	**10 Periods**
4.1	Main constructional features of synchronous machine including commutator and brushless excitation system	
4.2	Generation of three phase emf	
4.3	Concept of distribution factor and coil span factor and emf equation Armature reaction at unity, lag and lead power factor	
4.4	Equivalent circuit diagram of synchronous machine	
4.5	Concept of voltage regulation. Determination of voltage regulation by synchronous impedance method.	
4.6	Operation of single synchronous machine independently supplying a load.	
4.7	Concept of infinite bus bar. Need and necessary conditions of parallel operation of alternators, synchronizing an alternator (Synchroscope method) with the bus bars	
4.8	Effect of change in excitation of a synchronous motor, V curve, Concept of synchronous condenser.	
4.9	Operation of synchronous machine as a motor –its starting methods	
4.10	Concept and cause of hunting and its prevention	
4.11	Specification, rating and cooling of synchronous machines	
4.12	Applications of synchronous machines	
UNIT5:	**Special Purpose Machines**	**8 Periods**
5.1	Construction, working principle and application of linear induction motor, stepper motor, AC Servomotor, Submersible 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

SCHOOL OF POLYTECHNIC

RENEWABLE ENERGY SOURCES

(SPB10230505)

L	T	P
3	0	0

JUSTIFICATION

Since the conventional energy resources are under fast depletion, it is high time to tap the nonconventional 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.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

UNIT 1:	**Basic of Energy**	**8 Periods**
1.1	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 energy consumption(domestic, industrial, agriculture etc.), comparison between renewable and non-renewable energy resources.	
UNIT2:	**Solar Energy**	**8 Periods**
2.1	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.	
UNIT3:	**Bio-Energy and Wind Energy**	**10 Periods**
3.1	Bio-mass conversion technologies& their types- wet and dry processes. Methods for obtaining energy from biomass. Power generation by using gasifiers	
3.2	Wind energy conversion, windmills, electricity generation from wind- types of wind mills, local control, energy storage	
UNIT4:	**Geo-thermal and Tidal Energy**	**8 Periods**
4.1	Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion. Steam Generation and electricity generation. Different types of tidal energy systems.	
Unit 5:	**MHD, Fuel cell and Hydro Energy**	**8 Periods**
5.1	Magneto Hydro Dynamic (MHD) Power Generation	
5.2	Concept, types of fuel cells, operating principles of a fuel cell, conversion	

efficiency, work output and e.m.f of fuel cells, applications.

5.3 **Hydro Energy :** Mini & Micro hydro plants

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/NITTTR.

SCHOOL OF POLYTECHNIC

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

(SPB10230508)

L	T	P
3	0	0

JUSTIFICATION

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 CONTENTS

UNIT 1:	**ENTREPRENEURSHIP**	**04 Periods**
1.1	**Introduction**: Concept /Meaning and its need	
1.2	Qualities and functions of entrepreneur and barriers in entrepreneurship	
1.3	Sole proprietorship and partnership forms and other forms of business organization's	
1.4	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	
UNIT2:	**Market Survey and Opportunity Identification/Ideation**	**10 Periods**
2.1	Scanning of the business environment	
2.2	Salient features of National and Haryana State industrial policies and resultant business opportunities	
2.3	Types and conduct of market survey	
2.4	Assessment of demand and supply in potential areas of growth	
2.5	Identifying business opportunity	
2.6	Considerations in product selection	
2.7	Converting an idea into a business opportunity	
2.8	**Project report Preparation** : Preliminary project report	
2.9	Detailed project report including technical, economic and market feasibility	

2.10	Common errors in project report preparations	
2.11	Exercises on preparation of project report	
2.12	Sample project report	
UNIT3:	**Introduction to Management**	**12 Periods**
3.1	Definitions and importance of management	
3.2	Functions of management: Importance and process of planning, organising, staffing, directing and controlling	
3.3	Principles of management (Henri Fayol, F.W. Taylor)	
3.4	Concept and structure of an organisation	
3.5	Types of industrial organisations and their advantages	
3.6	Line organisation, staff organisation	
3.7	Line and staff organisation	
3.8	Functional organisation	
3.9	**Leadership:** Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders	
3.10	**Motivation:** Definition and characteristics, Importance of self-motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)	
UNIT4:	**Management Scope in Different Areas**	**10 Periods**
4.1	Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods	
4.2	Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ	
4.3	Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion	
4.4	Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST	
4.5	**Work Culture** : Introduction and importance of Healthy Work Culture in organization	
4.6	Components of Culture	
4.7	Importance of attitude, values and behavior	
4.8	Behavioral Science – Individual and group behavior.	
4.9	Professional ethics – Concept and need of Professional Ethics and human values	
UNIT5:	**Basic of Accounting and Finance**	**10 Periods**
5.1	Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company	
5.2	Objectives of Financial Management: Profit Maximization v/s Wealth Maximization	
5.3	**Miscellaneous Topics** : Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)	
5.4	Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark	

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/ NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

PLC, SCADA AND MICROCONTROLLER LAB

(SPB10230552)

L	T	P
0	0	2

JUSTIFICATION

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

1	Components / sub components of a PLC, 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

SCHOOL OF POLYTECHNIC

ELECTRICAL MACHINE –II LAB

(SPB10230553)

L	T	P
0	0	4

JUSTIFICATION

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

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

SCHOOL OF POLYTECHNIC

Industrial Training

(SPB10230560)

L	T	P
0	0	0

JUSTIFICATION

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%

Semester 6th

SCHOOL OF POLYTECHNIC

INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL EQUIPMENT

(SPB10230601)

L	T	P
4	0	0

JUSTIFICATION

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.

LEARNING 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**	**8 Periods**
1.1	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.	
UNIT 2:	**Installation**	**10 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, earth wire and guy wires. Laying of service lines, earthing, provision of service fuses, installation of energy meters	
UNIT 3:	**Laying of Underground Cables**	**10 Periods**
3.1	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

3.2 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..

3.3 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

3.4 Testing of Transformers: Type test, oil testing of transformers

Unit 4: Maintenance **10 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, and 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.

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

Unit 5: Maintenance of Distribution Transformers: **10 Periods**

5.1 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

5.2 Maintenance of Grid Substations Checking and maintenance of busbars, isolating switches, HT/LT circuit breakers, LT switches. Power transformers

5.3 Over hauling of motors, preventive maintenance, trouble shooting of electric motors

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/NITTTR, Chandigarh.

SCHOOL OF POLYTECHNIC

ELECTRICAL DESIGN, DRAWING AND ESTIMATING -II

(SPB10230602)

L	T	P
4	0	0

JUSTIFICATION

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.

LEARNING 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**	**8 Periods**
1.1	Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors, 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	
UNIT 2:	**Earthing**	**8 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	
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:	**Schematic Diagram of lighting system**	**12 Periods**
3.1	Schematic Diagram of lighting system of conference room/Theatre/sports stadium (indoor and outdoor) and Circuits using timers using CAD and, Drawing sheets	

3.2 **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

3.3 **Estimation of Power Wiring** I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductor's distribution board, main switches and starters for power circuits. Cost of equipment's and accessories and schedule of material. Estimation and cost of material and work for motors up to 20 H.P., pump sets and small workshops.

UNIT 4: Estimation of Overhead and Underground Distribution Lines **12 Periods**

4.1 Main components of overhead lines-line supports, cross-arm, clamps, conductors and stay sets, 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.

4.2 **Estimation of Service Connections** 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.

UNIT 5: Estimation of Small Sub-Station **8 Periods**

5.1 Main equipment's 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.

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//NITTTR

SCHOOL OF POLYTECHNIC

UTILIZATION OF ELECTRICAL ENERGY

(SPB10230603)

L	T	P
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JUSTIFICATION

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 economic 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.

LEARNING 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 **10 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.

UNIT 2: Electric Heating and Welding **12 Periods**

2.1 Advantages of electrical heating

2.2 **Heating Methods**

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	
2.5	**Electrolytic Processes** : Need of electro-deposition	
2.6	Laws of electrolysis, process of electro-deposition – clearing, operation, deposition of metals, polishing and buffing	
2.7	Equipment and accessories for electroplating	
2.8	Factors affecting electro-deposition	
2.9	Principle of galvanizing and its applications	
2.10	Principles of anodizing and its applications	
2.11	Electroplating of non-conducting materials	
2.12	Manufacture of chemicals by electrolytic process	
UNIT 3:	**Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers**	**8 Periods**
3.1	Principle of air conditioning	
3.2	Description of Electrical circuit used in a) Refrigerator, b) Air-conditioner, and c) Water cooler	
UNIT 4:	**Electric Drives**	**10 Periods**
4.1	Advantages of electric drives	
4.2	Characteristics of different mechanical loads	
4.3	Types of motors used as electric drive	
4.4	General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc.	
4.5	Examples of selection of motors for different types of domestic loads	
4.6	Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, and crane and lift etc. Application of flywheel. Selection of motors for Domestic Appliances	
UNIT 5:	**Electric Traction**	**10 Periods**
5.1	Advantages of electric traction	
5.2	Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub-urban, and main line and their speed time curves	
5.3	Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector-pantograph	
5.4	Factors affecting scheduled speed	

5.5 Electrical block diagram of an electric locomotive with description of various equipment and accessories used.

5.6 Types of motors used for electric traction

5.7 Power supply arrangements

5.8 Starting and braking of electric locomotives

5.9 Introduction to EMU and metro railways

5.10 Train Lighting Scheme

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/NITTTR.

SCHOOL OF POLYTECHNIC

INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL MACHINES LAB

(SPB10230651)

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JUSTIFICATION

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.

LEARNING OUTCOMES

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

1. Erect/install various electrical equipment as per IE Rules Act by adopting all safety measures.
2. Prepare specifications for different items required for transmission lines.
3. Design and excavation of cable trenches.
4. Lay underground cables
5. Test cables and their termination.
6. Check HT/LT circuit breakers, transformers and related equipment in a substation
7. Carry out earthing, make earth pits and measure earth resistance values.
8. Find fault in a transmission/distribution system.
9. Carry out preventive maintenance to minimize breakdowns.

DETAILED CONTENTS

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.

SCHOOL OF POLYTECHNIC

ELECTRICAL DESIGN, DRAWING AND ESTIMATION -II

(SPB10230652)

L	T	P
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JUSTIFICATION

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 has been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

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)

SCHOOL OF POLYTECHNIC

APPLICATION OF COMPUTER SOFTWARE IN ELECTRICAL ENGINEERING

(SPB10230653)

L	T	P
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JUSTIFICATION

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 software's, 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.

LEARNING 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

DETAILED CONTENTS

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.
11. Simulate single phase full-wave rectifier circuit.
12. Simulate single phase bridge rectifier circuit.

Project Work

(SPB10230663)

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JUSTIFICATION

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

DETAILED CONTENTS

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfilment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the project activities are given below:

- Projects related to designing small electrical equipment / instruments.
- Projects related to increasing productivity in electrical manufacturing areas.
- Projects related to quality assurance.
- Projects connected with repair and maintenance of plant and equipment.
- Projects related to design of PCBs.
- Projects related to design of small oscillators and amplifier circuits.
- Projects related to design, fabrication, testing and application of simple digital circuits and components.
- Projects related to microprocessor/microcontroller based circuits/ instruments.

A suggestive list of project is given below:-

1. Design and fabrication of control panel for various applications in the field of electrical engineering.
2. Rewinding of a single phase/three phase induction motor
3. Fabrication of working model of a solar thermal power plant.
4. Design and fabrication of automated car parking system.
5. Design and fabrication of automated gate control of railway crossing.
6. Design and fabrication of electrical resistive/inductive/capacitive loads.
7. Design and fabrication of remote control of various domestic electrical appliances.
8. Design and fabrication of microcontroller based DC drive system.
9. Design and fabrication of automatic water level control system.
10. Design and fabrication of automatic solar battery charger.
11. Fabrication of automatic star-delta starter.
12. Fabrication of working model of hydro- electric power plant.
13. Fabrication of sine wave inverter up to 500VA.
14. Fabrication of water level indicator.
15. Fabrication of rain/fire/ smoke/burglar detector.
16. Fabrication of automatic solar panel based street lights.
17. Fabrication of automatic solar panel based traffic lights
18. Fabrication of automatic voltage stabilizer up to 1 KVA.

19. Fabrication of working model of wind power plant.
20. Fabrication of heat convector blower with humidifier.
21. Fabrication of oil based radiation type room heater.
22. Fabrication of small 1- phase transformer up to 1KVA.
23. Fabrication of UPS up to 500VA.
24. Fabrication of a distribution board as per requirement.
25. Fabrication of Direct-On-Line (DOL) starter.
26. Fabrication of solar tracking system.
27. Fabrication of automatic power factor corrector.
28. Fabrication of desert cooler/ room cooler.
29. Fabrication of electric/solar water heater.
30. Erection, installation & commissioning of electrical equipments.
31. Fault detection & repair of electrical/ electronic instruments.
32. Drawing, estimating and costing of electrical installation of the institution from supplier's pole to the institution distribution board.
33. Drawing, estimating and costing of electrical installation of a workshop having a given number of electrically operated appliances/machines.
34. To study the laying out of underground distribution cable for a small colony starting from main distribution pole.
35. To study the erection of a 5 pole span overhead line for a small distance for distribution of electrical energy and to prepare list of material required.
36. Energy audit for the workshop of your institution & to suggest remedies to reduce electricity bills.
37. Estimate the material required to provide a service connection to a consumer's premises for domestic purposes.
38. To survey the load of a given area in a village, small colony, calculate the effective load and find out the sizes of cables/conductors for the proposed distribution system.
39. Designing of light and fan scheme for an institutional or commercial building.
40. To study and estimate the material required during augmentation of a nearby pole mounted sub-station.
41. To study and estimate the material required during augmentation of a nearby in door sub-station.
42. To study and estimate the material required for a solar power station up to 100KW after visiting the actual site
43. To prepare a proposal for substation of your institution , calculating the total load (estimating and costing)
44. Installation of home security system
45. Detection of electricity theft control system with wireless indication system
46. Fabrication of cyclo-converter (frequency changer)
47. Design and fabrication of panel for automatic switching of DG set with supply system
48. Design and fabrication of wireless AC Power transmission.
49. Design and fabrication of solar energy bored projects like solar cooker, solar dryer, solar street light, solar inverter, solar pump, solar emergency light etc.

NOTE:

- The project should be preferably undertaken by a group of students depending upon cost and time involved.
- There is no binding to take up the above projects as it is only a suggestive list of projects.