FINAL CURRICULUM

For

DIPLOMA PROGRAMME

IN

ELECTRICAL ENGINEERING

2nd Year (3rd & 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

18/19-09-2018

General Guidelines for Curriculum Implementation

1. Weightage for the internal assessment in respect of theory subjects will be as follow:
   - House Test: 40 %
   - Class Test: 20%
   - Home Assignment: 20%
   - Attendance: 20%
2. There will be two class tests in every semester and the average of the two tests will be taken into account.
3. The syllabus for the class tests will be as under:
   - Class Test-I: 30 % of syllabus
   - Class Test-II: next 30 % of syllabus
4. Class Test-I should be conducted in first week of March/September.
5. Class Test-II should be conducted in the second week of April/October.
6. The 30%, 60% and 80% contents of the syllabus will be based on the number of hours allocated for the topics in the detailed curriculum of each subject.
7. The question paper for both the class tests will be of 30 marks each and of one-hour duration.
8. Improvement test can be conducted after every class test on the basis of some genuine reason to be judged by the Head of concerned Department.
9. There will be one house test in the First week of May/November and syllabus converge will be 80%.
10. The house test will be of total 60 marks and the duration of House Test should be two hours.
11. There will be minimum two home assignments per subject per semester.
12. Weightage for the internal assessment in respect of Practical subjects should be: Practical Performance: 60% and Viva Voce : 40%
13. Weightage for Internal Assessment in respect of Drawing subjects will be as under:
    i. House Test and Class Test = 40%
    ii a) Class performance/Drawing Sheets=40%
    ii b) Attendance/punctuality = 10%
    ii c) Viva = 10%

    For iia), iib), iic) marks should be given in each drawing sheet by concerned teacher during evaluation.
14. It is suggested that students may be taken for industrial visits for industrial exposure in second year and third year.
15. **Student Centered Activities**: A provision has been made for organizing Student Centered Activities for overall personality development of students. SCA will comprise co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, cultural activities and participation in programs like technical and cultural events etc.

Distribution of marks for SCA will be as follows:

i. 20% marks shall be given for general behaviour

ii. 20% marks for attendance shall be based on the following distribution:

Attendance	Marks
Less than 65%	Nil
More than 65%	Proportionate

iii. 60% Marks shall be given for the Sports/NCC/Cultural and Co- curricular activities/other activities after due consideration to the following points:

1. For participation in sports/NCC/Cultural/ Co-curricular activities at National or above level, shall be rewarded with minimum of 40% marks

2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 30% marks

3. For participation in two or more of the listed activities, 20% extra marks should be rewarded

Note: These marks are to be sent to the H.P. Takniki Shiksha Board, Dharamsala at the end of semester along with internal assessment.

CONTENTS

- List of Subjects
- Study and Evaluation Scheme
- Detailed Contents of Various Subjects

THIRD SEMESTER

FOURTH SEMESTER

Industrial Training - After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 4 weeks and shall prepare a diary. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated during 5th semester.

Study & Evaluation Scheme-3rd Semester Electrical Engineering

SN	Subjects	Hrs/Week		Marks in Evaluation Scheme								Total Marks
				Int. Assessment			External Assessment					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
3.1	Fundamentals of Electrical Engineering	5	2	30	20	**50**	100	3	50	3	**150**	**200**
3.2	Electrical Machines-I	4	2	30	20	**50**	100	3	50	3	**150**	**200**
3.3	Electronic Devices & Circuits -I	4	2	30	20	**50**	100	3	50	3	**150**	**200**
3.4	Electrical & Electronics Engineering Materials	4	-	50	-	**50**	100	3	-	-	**100**	**150**
3.5	Electrical Engineering Design And Drawing	-	6	-	50	**50**	100	4	-	-	**100**	**150**
3.6	Electrical Workshop Practice – I	-	6	-	50	**50**	-	-	100	3	**100**	**150**
SCA		-	2	-	25	**25**	-	-	-	-	**-**	**25**
Total		**17**	**20**	140	185	**325**	500		250		**750**	**1075**

Study & Evaluation Scheme-4th Semester Electrical Engineering

SN	Subjects	Hrs/Week		Marks in Evaluation Scheme								Total Marks
				Int. Assessment			External Assessment					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.1	Electrical Machine-II	4	2	30	20	**50**	100	3	50	3	**150**	**200**
4.2	Electrical & Electronic Measuring Instruments	4	2	30	20	**50**	100	3	50	3	**150**	**200**
4.3	Electric Power –I	4	-	50	-	**50**	100	3	-	-	**100**	**150**
4.4	Electronic Devices & Circuits -II	4	2	30	20	**50**	100	3	50	3	**150**	**200**
4.5	Digital Electronics	4	2	30	20	**50**	100	3	50	3	**150**	**200**
4.6	Computer Programming & Applications	1**(T)**	2	-	50	**50**	-	-	50	3	**50**	**100**
4.7	Electrical Workshop Practice-II	-	6	-	50	**50**	-	-	100	3	**100**	**150**
SCA		-	2	-	25	**25**	-	-	-	-	**-**	**25**
Total		**21**	**18**	**170**	**205**	**375**	**500**		**350**		**850**	**1225**

T = Tutorial

Note: *Apart from the above mentioned number of hours for each subject (theory & practical), at least **TWO** hours/week for each class should be allocated for Library to motivate the students to attend library compulsory. The attendance of library period should be added in master attendance.*

DETAIL CONTENTS

OF

3^{RD} & 4^{TH} SEMESTER

ELECTRICAL ENGINEERING

3.1 FUNDAMENTALS OF ELECTRICAL ENGINEERING

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RATIONALE

For a diploma holder in electrical engineering, it becomes essential to know the fundamentals of the subject in order to grasp the knowledge of the field. This subject will provide acquaintance with various terms, knowledge of fundamental concepts of electricity, magnetism and various principles related to it.

DETAILED CONTENTS

1. Basic Electrical Concepts (5 Hrs.)

Basic Electrical Terminologies: Potential Difference (Voltage), Charge, Current, Resistance, Power & Energy-Their definition, units and their interrelation with each other.

2. DC Circuits (15 Hrs)

-Ohm's law, Resistances in Series and Parallel, Voltage & Current Divider Rules
-Effect of temperature on resistance, temperature coefficient of resistance, Resistivity.
-Kirchhoff's Laws and their applications in solving Electrical Network Problems.
-Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum Power Transfer theorem

3. Electrostatics (09 Hrs)

-Concept of Capacitance, Capacitor, Dielectric, Factors affecting Capacitance of a Capacitor.
-Capacitance of Parallel plates Capacitor & Cylindrical Capacitor.
-Grouping of Capacitors, Charging and Discharging of Capacitor, Time Constant, Energy Stored in a capacitor.

4. Batteries (07 Hrs)

-Working Principle, Construction and Applications of Lead acid, Nickel-Cadmium, Silver Oxide, and Li-ion Batteries
-Charging methods used for Lead acid battery.
-Care and maintenance of a Lead acid battery, testing of battery
-Grouping of cells in series and parallel (simple numerical problems).

5. Electromagnetism (12 Hrs)

-Introduction to Electromagnetism: Magnetic effect of electrical current MMF, Magnetic Flux, Reluctance, Permeability, Magnetic flux density (B), Magnetic field intensity (H), Analogy between Electric and Magnetic circuits.
-Cross and Dot Convention, Right Hand thumb rule and Cork screw rule, Nature of magnetic field around straight current carrying conductor, Concepts of Solenoid and Torroid.
-Force on a Conductor placed in the Magnetic field, Force between two Parallel current carrying conductors.
-Series & Parallel Magnetic circuits, Numerical problems on magnetic circuits.
-Concept of Hysteresis loop (B-H Curve) and Hysteresis loss.

6. Electromagnetic Induction (10 Hrs)

-Faraday's Laws of electromagnetic induction.
-Lenz's law.
-Fleming's Right and Left Hand Rule.
-Principle of self and mutual induction.
-Principle of Self and mutually induced e.m.f. and simple numerical problems
-Inductances in Series and Parallel.
-Energy stored in a magnetic field.
-Concept of Eddy current, Eddy current losses.

7. A.C. Circuits (22 Hrs)

-Concept of alternating current/EMF generation, Equation of instantaneous values of alternating current and voltage.
-AC terms: Cycle, Amplitude, Time period, Frequency, Instantaneous values, RMS value, Average value, Form factor, Peak factor. Numerical

-Representation of alternating sinusoidal quantities by vectors.
-Phasor algebra (addition, subtraction of complex quantities).
-AC through pure resistance, inductance and capacitance.
-Alternating voltage applied to RL, RC and RLC Series circuits (impedance triangle, phasor diagram and their solutions).
-Power in pure resistance (R), inductance (L), capacitance (C), RL, RC, and RLC circuits.
-Concept of Susceptance, Conductance and Admittance.
-Active and reactive components of current and their significance.
-Power factor and its practical significance,
-Resonance in series and parallel circuits, Quality factor, Numerical.

LIST OF PRACTICALS

1. Determination of voltage-current relationship in a DC circuit under specific physical conditions and to draw conclusions (verify ohm's law)

2. (a) To Calculate the values of total resistance of two or more resistances connected in series.
   (b) To Calculate the values of total resistance of two or more resistances connected in Parallel

3. Verification of Kirchhoff's Current law applied to DC circuits:
   a) To construct a circuit arrangement consisting of resistances in series, parallel combination
   b) Identification of node points in the circuit
   c) To verify that algebraic sum of currents at node point is zero

4. Verification of Kirchhoff's Voltage law applied to DC circuits:
   a) To construct a circuit arrangement consisting of resistances in series, parallel combination

   b) To verify that algebraic sum of EMFs and voltage drops in a closed loop is zero

5. To find ratio of inductance of a coil having air /iron core respectively and to see the effect of introduction of a magnetic core on coil inductance

6. To construct an R-L and R-C circuit and to measure
   a) Impedance
   b) Phase angle between voltage and current (power factor)
   c) And construct impedance triangle

7. To plot a graph between current and frequency of RLC series circuit for resonance conditions.

8. Measurement of power and power factor of a single phase RLC circuit. Also measure kVA and kVAr
9. Testing of lead acid battery using Hydrometer and Cell Tester

INSTRUCTIONAL STRATEGY

Basic electrical engineering being a fundamental subject need to be handled very carefully and in a manner such that students develop clear understanding of principles and concepts and develop skill in their application in solving related problems. Teacher may lay emphasis on laboratory experiments and give lot of tutorial work to students in order to give them an opportunity in mastering the basics in solving related problems

RECOMMENDED BOOKS

1. Electrical Science by V.K. Mehta, S Chand and Co., New Delhi
2. Electrical and Electronic Technology by Hughes, Pearson Education
3. Basic Electrical Engineering, by Kothari & Nagrath, Mc Graw Hill Publication
4. Fundamentals of Electrical Engineering by Sahdev, Unique International Publication, Jalandhar.
5. Electrical Technology by JB Gupta, SK Kataria and Sons, New Delhi
6. Electrical Science by S. Chandhni, R Chakrabarti and P K Chattopadhyay. Narosa Publishing House Pvt. Ltd., New Delhi
7. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill, New Delhi
8. Principles of Electrical Engineering by BR Gupta, S Chand & Co., New Delhi.
9. ABC of Electrical Engineering, Jain and Jain, Dhanpat Rai Pub.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	**Topic**	**Time Allotted**	**Marks Allocation (%)**
1	Basic Electrical Concepts	05	06
2	DC Circuits	15	20
3	Electrostatics	09	12
4	Batteries	07	08
5	Electromagnetism	12	14
6	Electromagnetic Induction	10	12
7	AC Circuits	22	28
Total		**80**	**100**

3.2 ELECTRICAL MACHINES - I

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RATIONALE

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. This part of the electrical machine covers polyphase circuits and transformers.

DETAILED CONTENTS

1. Polyphase Circuits (12 hrs)

1.1Advantage of 3-phase system over 1-phase system
1.2 Star-Delta Connection (phase current, line current, phase voltage, line voltage, relationship between phase & line parameters, phasor diagram)
1.3 Star-Delta Transformation
1.4 Power in 3-Phase circuit
1.5 Power Measurement in 3-phase circuit
1.6 Two Wattmeters method for measurement of Power and Power factor.

2. Single-Phase Transformer (26 hrs)

2.1 Constructional Features of Transformer: Shell type and core type transformer
2.2 Comparison between shell type and core type transformer
2.3 Working Principle of transformer
2.4 EMF equation of transformer, transformer ratio, rating of transformer (Numerical)
2.5 Concept of ideal transformer
2.6 Transformer phasor diagrams: Transformer phasor diagram on no-load and under loading conditions (Resistive, Inductive and capacitive load)
2.7 Equivalent circuit diagram of transformer referred to primary and secondary side.
2.8 Transformers Losses.
2.9 Tests on transformers: Polarity test, Open and short circuit test.

2.10 Transformer efficiency, all day efficiency, condition for maximum efficiency (derivation).

2.11 Voltage regulation of a transformer for resistive, inductive and capacitive load. (Numericals)

2.12 Parallel operation of single-phase transformer- Need and Necessary conditions.

3. Three-Phase Transformers (14 hrs)

3.1 Introduction and Construction of 3- phase transformer. Essential accessories of 3-phase Transformers: Conservator tank, breather, Buchholz's relay and their functions.

3.2 Advantage of a 3-phase (single unit) transformer over 3-phase transformer using 3- units of single phase transformers.

3.3 Three-phase transformer configurations: delta-delta, delta-star, star-star, star-delta and their phase and line voltage and current relations (No derivation only study)

3.4 Conditions for Parallel operation of Transformers.

3.5 Difference between Power transformer and Distribution transformer

3.6 Polarity test of 3-phase transformer.

3.7 Cooling methods in 3-phase transformer.

4. Special purpose Transformers (12 hrs)

4.1 Autotransformer: Construction & working principle, Difference between autotransformer and two-winding transformer, Advantage and disadvantage of autotransformer, Applications of autotransformer.

4.2 Instruments transformers: Current transformer (CT), Potential Transformer (PT), Difference between CT & PT, Applications of CT & PT

LIST OF PRACTICAL

1. Measurement of power and power factor by two wattmeter methods
2. To convert star connection of resistances into delta configuration and to find their equivalent value in delta mode and vice-versa.
3. To find turn ratio & polarity of 1-phase transformer.
4. To performs open circuit test on 1-phase transformer for determination of iron losses.
5. To performs short circuit test on 1-phase transformer for determination of copper losses.
6. To find the efficiency and voltage regulation of 1-phase transformer by actually loading it.
7. Parallel operation of two single-phase/3-phase transformers & to study the load shared by each transformer.
8. Determination of dielectric strength of transformer oil using oil testing setup.

RECOMMENDED BOOKS

1. Electrical Machines by S.K. Bhattacharya, Tata McGraw Hill, New Delhi
2. Electrical Machines by S.K. Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi
4. Electrical Machines by J.B. Gupta, SK Kataria and Sons, New Delhi
5. Electrical Machines by Dr. P. S Bhimbra, Khanna Publications, Delhi
6. Electrical Science by V.K. Mehta, S Chand and Co., New Delhi
7. Electrical and Electronic Technology by Hughes, Pearson Education
8. Basic Electrical Engineering, by Kothari & Nagrath, Mc Graw Hill Publication

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted	Marks Allocation (%)
1	Polyphase Circuits	12	20
2	Single -Phase Transformer	26	40
3	Three-Phase Transformers	14	20
4	Special purpose Transformers	12	20
Total		**64**	**100**

3.3 ELECTRONIC DEVICES & CIRCUITS-I

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RATIONALE

Having attained basic knowledge of Semiconductor Physics in Second semester, this course will enable the students to learn about the use of transistors in analog circuits like voltage amplifier, power amplifier, multistage amplifier, etc. It also gives information about FET, MOSFETs, and their applications for effective functioning in the field of electronic service industry.

1. Concept of Voltage and Current Source (4 Hrs)

Concept of Voltage & Current Sources, Conditions for source to act as voltage source and current source, Graphical representation of voltage and current sources, difference between ideal and practical sources, Conversion of voltage source into current source and vice-versa.

2. Review of Basic Electronics **(**8 Hrs.)

P-N Junction, Semiconductor Diode Characteristics (Forward/reverse), Zenor Diode, Zenor diode characteristics, Zenor Diode as Voltage Regulator, Application of diode as Rectifier (Half-wave, Full wave: Centre tap & bridge configuration), ripple factor, filter circuit in rectifier

3. Transistor (18 hrs)

Transistor: Constructional Features of Transistor (PNP & NPN Type), Working Principle of Transistor, Working of Transistor as an Amplifier, Concept of Transistor biasing and selection of operating point, Potential divider biasing Circuit. Need for stabilization of operating point.
Configurations of Transistor: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input/Output Characteristics of Transistor in CB, CE & CC Modes

Transistor as an Amplifier (CE mode), Concept of DC load line and operating point. Performance characteristics of transistor amplifier i.e. input resistance, output resistance, effective collector load, current gain, voltage gain & power gain, Explanation of phase reversal of output voltage with respect to input voltage and its graphical demonstration, Concept of AC load line

Emitter Follower Circuit, Working of Transistor as a Switch

4. Multistage Amplifiers (12 hrs)

Need for multistage amplifier; Gain of multistage amplifier; Expression of gain of

Amplifier in dB, Different types of multistage amplifier: RC coupled, Transformer coupled, and Direct coupled amplifier, Frequency response and bandwidth of RC Coupled Amplifier.

5 Large Signal Amplifiers **(**08 hrs)

Difference between Voltage & Power Amplifier, Importance of Impedance matching in Amplifiers, Classification of Amplifiers: Class A, Class B, Class C, Class AB, Push Pull Amplifier-Circuit Description & Working, Complementary Push-Pull Amplifier Circuit

6. Feedback in Amplifiers (8 hrs)

Types of feedbacks in Amplifier, Derivation of expression for gain of an amplifier employing feedback (negative & positive), Effect of negative feedback on gain, gain stability, distortion, frequency response, bandwidth and input & output impedance of an amplifier.
RC coupled amplifier circuit with & without emitter bypass capacitor, Advantages and disadvantages of negative feedback in amplifier circuit.

7. Field effect transistors (FET) (06 hrs)

Construction, working principle and V-I characteristics of FET, difference between FET and Bipolar junction transistor (BJT), Difference between MOSFET and FET, Comparison between BJT, FET and MOSFET in terms of their features and applications.

LIST OF PRACTICALS

1. To identify various types of electronic components such as resistors, capacitors, inductors, diodes & transistors and to identify the terminals of diodes & transistor using multimeter.
2. To plot the V-I characteristics (forward and reverse) of semiconductor diode
3. To plot the V-I characteristics of Zenor diode.
4. To plot input and output characteristics of transistor in CE configuration. Calculate input and output resistance and voltage gain.
5. To measure the voltage gain of two stages RC coupled amplifier.
6. To plot the frequency response of two stages RC coupled amplifier & calculate the bandwidth.
7. To study and measure the voltage gain of Push-Pull Amplifier Circuit
8. To measure the voltage gain of emitter follower circuit and plot its frequency

response.

9. To measure the gain of RC Coupled Amplifier Circuit with and without emitter bypasses capacitor.
10. To plot the V-I characteristics of FET.

LIST OF RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by N.N. Bhargava, Tata McGraw Hills, New Delhi
2. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
3. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
4. The Art of Electronics by Horowitz & Winfield Hill
5. Electronic Devices & Circuit Theory by Robert L. Boylestad, Pearson Publication
6. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
7. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted	Marks Allocation%
1	Concept of Voltage & Current Sources	04	05
2	Review of Basic Electronics	08	10
3	Transistors	18	25
4	Multistage Amplifiers	12	20
5	Large Signal Amplifiers	08	15
6	Feedback in Amplifiers	08	15
7	Field effect transistors	06	10
Total		**64**	**100**

3.4 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

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RATIONALE

A diploma holder in Electrical & Electronics Engineering will be involved in maintenance, repair and production of electrical equipment and systems. In addition, he or she 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 is high.

DETAILED CONTENTS

1. **Classification of Materials** (6 Hrs)

Classification of materials on the basis of their atomic structure and energy bands theory.

2. **Conducting Materials** (16 Hrs)

2.1 Classification of Conducting material into low-resistivity and high-resistivity materials.

2.2 General/Electrical properties: Resistivity, temperature coefficient, Factors affecting resistivity (Temperature, Alloying, Hot & cold rolling, age etc.) Mechanical properties: corrosion, contact resistance, Solderability etc. Applications of low and high resistivity materials (Copper, Aluminum, Steel, Carbon, Brass, Bronze, Tungsten, Lead, Platinum and Mercury) in the field of electrical engineering.

2.3 Superconductivity, Super-conducting materials and their applications

3 **Insulating Materials** (22 Hrs)

Properties of insulating materials

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 reliability

3.5 Mechanical properties: mechanical structure, tensile strength

3.6 Classification of insulating materials on the basis of physical and chemical structure and their applications:

-PVC, Bakelite, Mica, Epoxy resin, Asbestos

-Fibrous materials (Wood, Paper, and insulating textiles), impregnated Fibrous materials (impregnated insulating paper, varnished textiles) and non-resinous materials (bitumen, waxes).

3.7 Insulating Liquids: Main feature and applications of mineral insulating oils.

3.8 Insulating Gases: Main feature and their applications of nitrogen, hydrogen and SF_6 (Sulphur Hexafloride).

3.9 Applications of insulating materials

4. Magnetic Materials (15 Hrs)

4.1 Types of Magnetic materials: Diamagnetic, Paramagnetic and Ferromagnetic

4.2 B-H curve, Eddy and Hysteresis Losses, Curie Point and Magnetostriction

4.3 Soft Magnetic Materials:

- 4.3.1 Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines
- 4.3.2 Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machines
- 4.3.3 Nickel-iron alloys
- 4.3.4 Soft Ferrites

4.4 Hard magnetic materials: Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications.

5. Specific Purpose Materials (5Hrs)

Thermocouple, bimetals, soldering and fuse materials: Their properties and applications.

INSTRUCTIONAL STRATEGY

The teacher should bring different materials, electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he may give emphasis on practical applications of these devices and components in the field. In addition, the students should be given exercises on identification of materials used in various electronic gadgets etc .and be encouraged to do practical work independently and confidently.

RECOMMENDED BOOKS

1. Electrical and Electronic Engineering Materials by G. K. Banerjee, PHI Publication
2. Electrical and Electronic Engineering Materials by J. B. Gupta, KATSON Publication
3. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
4. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi
5. Electrical Engineering Materials by Sahdev, Unique International Publications
6. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
7. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
8. Electrical and Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
9. Electrical Engineering Materials by Rakesh Dogra, SK Kataria and Sons, NEW Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

Sr.No.	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Classification	06	10
2	Conducting Materials	16	25
3	Insulating materials	22	30
4	Magnetic Materials	15	25
5	Specific Purpose Materials	05	10
	Total	**64**	**100**

3.5 ELECTRICAL ENGINEERING DESIGN & DRAWING

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RATIONALE

A polytechnic pass-out in electrical engineering is supposed to have ability to:

i) Read, understand and interpret electrical engineering drawings
ii) Communicate and co-relate through sketches and drawings
iii) Prepare working drawings of panels, transmission and distribution system

DETAIL CONTENTS

1. Symbols and Signs Conventions (3 Sheets)

Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per BIS.

2. Wiring Diagrams : (5 Sheets: 2 Questions per sheet)

2.1 Design and Drawing of panels/Distribution board using MCBS, ELCB main switches.
2.2 Single line and wiring diagram of light, fan, and Power Point for a drawing room measuring 7m x 5m. Select suitable numbers of points for this room
2.3 Single line and wiring diagram of workshop measure 10m x 4m containing 2 three-phase induction motors of 2 HP & 5 HP rating and two single phase induction motors of 1 HP rating each.
2.4 Simple Electric Circuits (Wiring and Single line diagram).

3. Projections of Electrical Accessories & Machines Parts (5 Sheets)

3.1 Bus Bar post
3.2 Pin type and Shackle insulators
3.3 Rotor of a Squirrel cage induction motor
3.4 Pole and Coil of DC Machine.
3.5 Slip rings of 3-phase Slip-ring induction Motor.

4. Contactor Control Circuits: Schematic and Wiring Diagram (3 Sheets)

4.1 DOL Starter of 3-phase induction Motor.
4.2 Forwarding/reversing of 3-phase induction motor

4.3 Limit switch control of a 3-phase induction motor

5. E-CAD: (4 exercises **but not to be set for External Exam)**

Introduction & interpreting drawings related to Electrical substation, Industries & domestic electrical circuits using E-CAD

DISTRIBUTION OF MARKS

SN	**Topic**	**Time Allotted(hrs)**	**Marks Allocation (%)**
1	Symbols and Signs Conventions	12	15
2	Wiring Diagrams	26	30
3	Projections of Electrical Accessories & Machines parts.	26	30
4	Contactor Control Circuits: Schematic & Wiring Diagrams	18	25
5	E-CAD	14	Nil
Total		**96**	100

RECOMMENDED BOOKS

1. Electrical Engineering Drawing by S. K. Bhattacharya, New Age International Publishers

2. Electrical Engineering Drawing-I by Surjit Singh, KATSON Publications New Delhi.

3. Electrical Engineering Drawing-II by Surjit Singh, KATSON Publications New Delhi

4. Electrical Engineering Drawing by C. R. Dargan, Computech Publication, New Delhi

5. Electrical Engineering Design & Drawing by G. L. Marwaha, Eagle's Publication Jallundhar

3.6 ELECTRICAL WORKSHOP PRACTICE-I

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-	-	6

RATIONALE

An electrical diploma holder will be required to inspect, test and modify the work done by skilled workers working under him. In addition, many a times, it will become necessary for him to demonstrate the correct method and procedure of doing a job. In order to carry out this function effectively in addition to conceptual understanding of the method or procedure he must possess appropriate manual skills. The subject aims at developing special skills required for repairing, fault finding, wiring in electrical appliances and installations.

DETAIL CONTENTS

1. Study of electrical safety measures as mentioned in the Electricity Rules
2. Demonstration of shock treatment procedure including first aid to be given in case of electric shock
3. Wiring of following light circuits using Casing-capping (PVC) and conduit system of wiring
    - 3.1 Two lamps controlled by two switches
    - 3.2 Two lamps connected in series controlled by a single way switch
    - 3.3 Two lamps connected in parallel controlled by a single way switch
    - 3.4 One lamp controlled by two switches (staircase circuit)
    - 3.5 Two lamps controlled by three switches (double staircase circuit)
4. Wiring and testing of alarm and response circuit using relay, push buttons and bells (simple single phase circuit)
    - 4.1 Bell response circuit using one bell and one relay
    - 4.2 Bell response circuit of an office (for three rooms)
5. Wiring of a switch board containing at least two switches, one fan regulator and one 5/15A socket controlled by their respective switches using switches and matching sockets.
6. Wiring of a series test lamp board and to use it for finding out common faults
7. Testing of domestic wiring installation using Meggar
8. Internal wiring connection, fault finding and repair of a fluorescent tube light (by testing of choke, starter, tube holder, tube rod).
9. Assembly of distribution board/ panel using MCB, main switch, changeover switch and ELCB.
10. Repair and maintenance of domestic electric appliances: electric iron, geyser, fan, heat convector, Semi-automatic washing machine, room heater, electric kettle, induction heater, mixture-grinder.

Note: At least 4 electrical appliances as mentioned above are given to a group of 2 students for their repair and maintenance.

INSTRUCTIONAL STRATEGY

Teacher should identify/prepare more exercises on electrical wiring. The teacher should make the students confident in practical execution of the wiring. The students must also be given the practical exercises on identification of the faults in the electrical wiring & domestic household appliances and they should be trained to rectify these faults.

RECOMMENDED BOOKS

1. Electrical Workshop: A Text Book by R. P. Singh, I. K. International Publishing House
2. Workshop Practices in Electrical Engineering by M. L. Gupta, Metropolitan Book Company.
3. Electrical Engineering Drawing-I by Surjit Singh, KATSON Publications New Delhi.
4. Electrical Engineering Drawing-II by Surjit Singh, KATSON Publications New Delhi
5. My Electrical Workshop by Thomton Addyman, The Wireless Press

4.1 ELECTRICAL MACHINES - II

L T P

4 - 2

RATIONALE

In this subject 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. This part of the electrical machines covers basic concepts of rotating machines and DC machines.

DETAILED CONTENTS

1. Rotating Machine: Basic Concepts (10Hrs)

1.1 Principle of Energy conversion
1.2 Rotating Electrical Machine: definition of electrical machine, generator & motor
1.3 Physical concept of torque production: electromagnetic torque, reluctance torque and concept of torque angle

2. DC Machines (14 Hrs)

2.1 Constructional features of DC Machine
2.2Type of windings in DC machine: field and armature windings
2.3 Armature windings: lap & wave winding, armature winding terminologies (conductor, turn, coil, coil group, pole pitch, coil span, full-pitched coil, short-pitched coil, back & front-pitch)
2.4 Function of the Commutator in Motoring and Generating action
2.5 Armature Reaction in DC machine
2.6 Commutation, cause of sparking, method to improve commutation
2.7 Power flow diagram of DC Machines

3. DC Generator (16Hrs)

3.1 Working principle of DC generator
3.2 Induced EMF equation & factors determining the EMF of generator
3.3 Electromagnetic torque equation & factors determining the torque
3.4 Relationship between generated EMF and generator terminal voltage

3.5 Types of DC generator: separately excited, shunt wound, series wound and compound (differential or cumulative type) generator

3.6 Necessary conditions to build up induced EMF in a DC shunt generator.

3.7 Operating characteristics of separately excited, Shunt, Series and Compound DC generator

3.8 Losses in DC Generator, Efficiency of DC Generator

4. DC Motor (20 hrs)

4.1 Working principle of DC motor

4.2 Back EMF equation and its significance

4.3 Torque equation of DC motor

4.4 Equivalent Circuit diagram

4.5 Relationship between back EMF and terminal voltage

4.6 Types of DC motors: Series motor, Shunt motor and Compound motor (differential and cumulative)

4.7 Need of Starter, 3-point Starter, 4-point Starter

4.8 Speed control of DC series and shunt motors: Armature & Field control methods and Ward Leonard method.

4.9 Operating characteristics of DC motors: Shunt, Series and Compound motors.

4.10 Effect of armature resistance on Torque-speed curve,

4.11 Losses in DC motor, Efficiency of DC motor: Direct method (direct mechanical loading method), Indirect method (Swinburne's method) and regenerative method (Hopkison's method)

5 Applications and Maintenance of DC Machine (4Hrs)

5.1 DC generator applications

5.2 DC motor applications

5.3 DC Machines (motor & generator) testing and maintenance

LIST OF EXPERIMENTS

1. Starting of DC motor with help of three point and four point starter
2. To plot the open circuit characteristics (OCC) of separately excited DC generator
3. Measurement of induced EMF of a DC Shunt generator as a function of field current
4. Measurement of terminal voltage of a DC shunt generator as a function of load current.
5. To start DC series motor with two point starter and to observe the speed.
6. Speed control of DC shunt motor using Armature control method
7. Speed control of DC shunt motor using Field control method.
8. Measurement of the speed of a DC shunt motor as a function of load torque
9. Determination of efficiency of DC motor by Swinburne's Test.

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata McGraw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi
4. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi
5. Electrical Machines by Dr. P. S Bhimbra, Khanna Publications, Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	**Topic**	**Time Allotted**	**Marks Allocation (%)**
1	Rotating Machine: An Overview	10	15
2	Basic Concepts of DC Machine	14	20
3	DC Generator	16	25
4	DC Motor	20	30
5	Applications & Maintenance of DC Machine	04	10
Total		**64**	**100**

4.2 ELECTRICAL & ELECTRONIC MEASURING INSTRUMENTS

L	T	P
4	-	2

RATIONALE

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.

DETAIL CONTENTS

1. **Introduction to Electrical Measuring Instruments** (05 hrs)

   1.1 Concept of Measurement and Instruments.
   1.2 Block diagram of generalized measurement Systems,
   1.3 Measurement Terms: Accuracy, precision, linearity sensitivity, reproducibility, dead band, Range.
   1.4 Types of electrical measuring instruments – indicating, integrating and recording type instruments.
   1.5 Essentials of indicating instruments – deflecting, controlling and damping torque, methods of achieving deflecting & controlling torques in analog instruments.

2. **Ammeters and Voltmeters (Moving coil and moving iron type)** **(**09 hrs)

   2.1 Concept of Galvanometer, Ammeter, Voltmeter and difference between them, Extension of the range of ammeter & voltmeter, Numerical related to extension of range of meters.
   2.2 Construction and working principles of moving Iron and moving coil instruments.
   2.3 Merits and demerits, sources of error and application of these instruments.

3. **Wattmeter (Dynamometer Type)** (06 hrs)

   Construction, working principle, merits and demerits of dynamometer type wattmeter, sources of error.

4. **Energy Meter (Induction type)** (06 hrs)

4.1 Construction, working principle, merits and demerits of single-phase and three-phase energy meters, numerical problems.

4.2 Errors and their compensation.

4.3 Construction and working principle of maximum demand indicator.

5. **Measurement of Resistance, Inductance & Capacitance using Bridges** (07 Hrs)

Principal of Working of Wheatstone Bridge, limitations of Wheatstone bridge, Measurement of medium resistance by ammeter, voltmeter method, Kelvin's double bridge for measurement of low resistance,

A.C. bridges: Maxwell Bridge for Inductance measurement, Wien Bridge for Capacitance measurement.

6. **Miscellaneous Measuring Instruments** (11 hrs)

Construction, working principle and applications of

6.1 Meggar (Insulation Resistance tester)

6.2 Earth tester

6.3 Frequency meter (dynamometer type)

6.4 Single phase power factor meter (Electrodynamometer type).

6.5 Synchroscope

6.6 Clamp-on meter.

6.7 LCR meter

7. **Electronic Instruments** (09 hrs)

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

7.2 Digital multi-meter (only block diagram) and Applications.

7.3 Introduction and block diagram of Digital single phase and three phase Energy meters.

7.4 Introduction to Intelligent Energy Meter, Load manager.

8. **Transducers & Their Application in Measurement of Non-electrical Quantities** (17 hrs)

8.1 Introduction and classification of transducers

8.2 Use of Potentiometers in displacement measurement

8.3 Working principle and applications of LVDT.

8.4 Pressure sensing devices, measurement of pressure using

- LVDT and Bourdon tube arrangement
- Manometer

8.5 Working principle Strain gauge and its applications in measurements,

temperature compensation using Strain gauge bridges.

8.6 Measurement of temperature using
- Thermometers
- Thermocouple
- Resistance temperature detector
- Thermistor
- Optical Pyrometer.

8.7 Electromagnetic flow meter for flow measurement

8.8 Liquid level measurement using
- Floats
- Resistive and Capacitive probes

7.7 Introduction to Smart Sensors.

LIST OF PRACTICAL

1. Use of analog and digital multi-meter for measurement of voltage, current (AC/DC) and resistance
2. Use of LCR meter for measuring inductance, capacitance and resistance.
3. To calibrate 1-phase energy meter by direct loading method.
4. To measure the value of resistance using Wheatstone bridge
5. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.
7. To measure Energy at different Loads using Single phase Digital Energy meter.
8. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
9. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric) or Digital Tachometer.

INSTRUCTIONAL STRATEGY

After making students familiar with measuring instruments, they should be made conceptually clear about the constructional features and make them confident in making connection of various measuring instruments. Teacher should demonstrate the application of each measuring instrument in laboratory and encourage students to use them independently.

RECOMMENDED BOOKS

1. Electrical Measurements and Measuring Instruments by Golding and Widdis; Wheeler Publishing House, New Delhi
2. Industrial Instrumentation by Dr. Umesh Rathore, KATSON Publication, New Delhi
3. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
4. Electronic Instrumentation and Measurement Technique, by W. D. Cooper & A. D. Helfrick, Pearson INDIA
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
6. Electronics Instrumentation by Umesh Sinha, Satya Publication, New Delhi
7. Electrical Measurements and Measuring Instruments by SK Sahdev, Unique International Publications, Jalandhar
8. Electrical Measurement and Measuring Instruments by JB Gupta, SK Kataria and Sons, New Delhi
9. Electrical Measurement and Measuring Instruments by ML Anand, SK Kataria and Sons, New Delhi

Sr. No.	**Topic**	**Time Allotted**	**Marks Allocation(%)**
1	Introduction to Electrical Measuring Instruments	05	10
2	Ammeters and Voltmeters (Moving coil and moving iron type)	07	15
3	Wattmeter	05	10
4	Energy meter	05	10
5	Measurement of Resistance, Inductance & Capacitance using Bridges	07	10
6	Miscellaneous Measuring Instruments	09	15
7	Electronic Instruments	09	10
8	Transducers & Their Application in Measurement of Non-electrical Quantities	17	20
Total		**64**	**100**

4.3 ELECTRICAL POWER SYSTEM-I

L	T	P
4	-	0

RATIONALE

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma pass out 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 understand the concepts and principles involved in the construction and working of various types of electrical power generating stations, economics of power generation and tariffs system. The teaching of this subject requires reinforcement in the form of visits to power stations.

DETAILED CONTENTS

1. Sources of Electrical Power Generation (06 hrs)

1.1 Conventional sources of electrical power generation such as coal, hydro, nuclear, natural gases and their contribution in power generation in present energy scenario

1.2 Non-conventional sources of electrical power generation such solar, wind, mini hydro, geothermal, tidal: Their relevance and contribution in power generation in present energy scenario

2. Hydroelectric Power Plant (13 hrs)

2.1 Introduction: Hydrology, Calculation of power generated in hydro power plant.
2.2 Hydro power plant layout, function of each component.
2.3 Selection of site for hydro power plant.
2.4 Classification of hydro power on the basis of water discharge & head available.
2.5 Water Turbine: Various types of water turbines and their comparison on the basis of head, discharge, speed and direction of water flow
2.6 Merits and demerits of hydro power plant.

3. Steam Power Plant (13hrs)

3.1 Site selection for steam power plant
3.2 Layouts of various sections in steam power plant
3.3 Function of heat exchanger, economizer & cooling tower in steam power plant
3.4 Efficiency of steam power plant
3.5 Merits and demerits of steam power plant

4. Nuclear Power Plant (07 hrs)

4.1 Introduction: Nuclear reaction, nuclear fission & fusion.
4.2 Site selection for nuclear power plant

4.3 Layout of nuclear power plant & function of each component
4.4 Nuclear reactor control
4.5 Safety issues and their remedial measures in nuclear power plant
4.6 Merits and demerits of Nuclear Power Plants
4.7 Nuclear Waste Disposal

5. Diesel Power Plant (05 hrs)

5.1 Elements of Diesel Power Plant & function of each components
5.2 Merits and demerits of diesel power plant
5.3 Performance and efficiency of diesel power plant
5.4 Applications of diesel power plant

6. Economics of Power Generation (13 hrs)

6.1 Fixed and running cost, load estimation, load curves, connected load, maximum demand, demand factor, diversity factor, Chronological load curve, load duration curve, Energy load curve, load factor, Capacity factor, utilization factor, numerical problems.
6.2 Classification of Power Plants: Base load, peak load and standby power stations, stand by capacity in power plants, selection of number and size of units for different types of power stations.
6.3 Inter-connection of power stations and its advantages, concept of regional and national grid.

***7.* Tariffs** (07 hrs)

7.1 Concept of Tariffs
7.2 Types of Tariff system**,** Numerical problems related to electricity tariff

RECOMMENDED BOOKS

1. A Course in Electrical Power by A. Chakarborty, M.L. Soni, P.V. Gupta and U.S. Bhatnagar, Dhanpat Rai & Sons, New Delhi
2. Principles of Power Systems by VK Mehta, S Chand and Co., New Delhi
3. Power System(Analysis & Design) by Dr. B. R. Gupta, S Chand and Co., New Delhi
4. Electrical Power – II by SK Sahdev, Unique International Publications, Jalandhar (Pb)
5. Energy Management by Dr. Sanjeev Singh & Dr. Umesh Rathore, KATSON Publications New Delhi
6. Electrical Power Systems by B. M. Weedy, Wiley Publishing

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Sources of Power Generation	06	10
2	Hydroelectric power plant	13	20
3	Steam power plant	13	20
4	Nuclear power plant	07	10
5	Diesel Power plant	05	10
6	Economic generation	13	20
7	Tariffs	07	10
Total		**64**	**100**

4.4 ELECTRONIC DEVICES & CIRCUITS-II

L	T	P
4	-	2

RATIONALE

Having attained basic knowledge of diodes, transistors and amplifier circuits, this course will enable the students to learn about the use of transistors as an oscillator, electronic switch and its application on wave shaping circuits etc. It also gives information about Optoelectronic devices, OPAMP and their applications in the field of electronic service industry and regulated power supplies.

1 Sinusoidal Oscillators (12 hrs)

Working Principle of Oscillator, Use of positive feedback in amplifier circuit; Barkhausen criterion, Difference between Oscillator & Electrical Generator.
Different Types of Oscillator circuits: Tuned collector, Hartley, Colpitts, Phase shift, Wien Bridge, and Crystal oscillator-Their working principle, frequency range and applications

2 Tuned Voltage Amplifier (7 hrs)

Series and Parallel Resonant Circuits, Comparison between Series and Parallel resonant Circuits, Single & Double Tuned Voltage Amplifier Circuits and their frequency response

3 Wave Shaping Circuits (09 hrs)

- Integrating and differentiating circuits: Their working and applications
- Diode Clipping circuits, biased Clipping circuits
- Clamping circuits

4. Multivibrator Circuits (09 hrs)

- Working principle of Transistor as Switch
- Concept of Multi-vibrator: Astable, Monostable, and Bistable
- Block diagram of IC555 and its working and applications
- Working of IC555 as astable and monostable multivibrator
- Applications of Multivibrator Circuits

5. Operational Amplifiers (11 hrs)

- Characteristics of an ideal operational amplifier and its block diagram, Pin Identification of IC741
- Definitions: Differential voltage gain, CMRR, slew rate, input offset current, input offset voltage, total output offset voltage.

- Open loop configurations: Differential, Inverting & Non Inverting modes, limitations of open loop configuration.
- Closed loop configuration: As an Inverting & Non-inverting amplifier, Schmitt trigger circuit, Comparator, Differentiator and Integrator

6. Optoelectronic Devices (7hrs)

Working principle of Photo-resistor, photo diode, photo transistor and their applications, Need for Opto-isolation in electronic circuit, Working of optocoupler circuit.

7. Regulated Power Supplies (9 hrs)

- Working of DC regulated power Supply
- Line and load side regulation
- Regulator ICs (78XX, 79XX)

-Switching Mode Power Supply (SMPS)-Working Principle, advantages & applications.

LIST OF PRACTICAL

1. To measure the frequency of the generated signal in Harley or Colpitt oscillator circuit and observe the output using oscilloscope.
2. To measure the frequency of the generated signal in Crystal oscillator circuit and observe the output using oscilloscope
3. To observe the response of RC Differentiator Circuit with square wave at the input. Observe the wave at output.
4. To observe the response of RC Integrator Circuit with square wave at the input. Observe the wave at output.
5. Observe the output at Clipper Circuit using diode clipper circuit with AC Signal at the input of clipper circuit. Observe the input /output waveform using Oscilloscope.
6. Observe the output at Clamper Circuit using diode clamper circuit with AC Signal at the input of circuit. Observe the input /output waveform using Oscilloscope at different biasing voltages in the clamper circuit.
7. Use of IC 555 as monostable multivibrator and observe the output for different conditions
8. Use of IC 555 as astable multivibrator and observe the output at different conditions
9. Design & build inverting and Non-inverting amplifier of desired voltage gain using OPAMP
10. Study and build a power supply using IC 7805/7905/7812

LIST OF RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by N.N. Bhargava, Tata McGraw Hills, New Delhi
2. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
3. Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
4. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
5. Electronics by Grob, Tata McGraw Hills, New Delhi
6. The Art of Electronics by Horowitz & Winfield Hill
7. Electronic Devices & Circuit Theory by Robert L. Boylestad, Pearson Publication
8. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
9. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd.,New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted	Marks Allocation%
1	Sinusoidal Oscillators	12	15
2	Tuned Voltage Amplifier	07	15
3	Waveshaping Circuits	09	15
4	Mutivibrator Circuits	09	15
5	Operational Amplifiers	11	20
6	Optoelectronic Devices	07	10
7	Regulated Power Supplies	09	10
	Total	**64**	**100**

4.5 DIGITAL ELECTRONICS

L	T	P
4	-	2

RATIONALE

To familiarize students with Boolean algebra, concepts of logic circuits, realization of various logic circuits using different logic gates. After this course the student will be able to design simple logic circuits, understand flip-flops, counters, registers and A/D & D/A converter circuits and their applications in electronic based control and switching circuits.

Pre-Requisite -

1. Basic Electronics Engineering

DETAIL CONTENTS

1. Introduction **5 hrs**

Analog Signal, Digital Signal, Difference between Analog & Digital Signal, Applications & Advantages of Digital Signal

2. Number System **9 hrs**

- Binary, Octal, & Hexadecimal number systems, Conversion from Decimal, Octal & Hexadecimal Systems to Binary System & Vice Versa.
- Binary Addition, Subtraction, Multiplication, Division, 1's and 2's compliment methods of subtraction.
- Concept of code: 8421, BCD, Excess 3 and Gray Code
- Concept of Parity

3. Logic Gates & Families **11 hrs**

- Logic symbol, logical expression and truth table of AND, OR, NOT, NAND, NOR, EX- OR gates,
-Universal property of NAND and NOR gate.
- Logic Simplification Circuits-Basic laws of Boolean algebra, Duality theorem, De Morgan's Theorems.
- Boolean expressions using Sum of Products (SOP) and Product of Sums (POS) forms.
- K-map representation of logical functions.
- Minimization of logical expressions using K-map (2, 3, 4 variables).
-Logic Gates & Families (SSI, MSI, LSI, VLSI, ULSI)

4. Arithmetic Circuits **7 hrs**

- Half Adder/Full Adder Circuit, their design and implementation
- Half Subtracter /Full Subtracter Circuit, their design and implementation

5. Decoder, Encoder, Multiplexer & De-Multiplexer **9 hrs**

- Basic binary decoder, Encoder-Decimal to BCD Encoder
- Block diagram, Truth table, Logical expression and logic diagram of Multiplexers (4:1 and 8:1).
- Block diagram and Truth table of Demultiplexer (1:4 and 1:8)

6. Flip Flops, Counters, Shift-Registers **15 hrs**

-One-bit memory cell, clock signal, Latch-SR Latch, Difference between Latch & Flip-Flop

-**Flip Flops**: S-R Flip flop, D- Flip Flop, J-K Flip Flop, Master Slave Flip-Flop, T- Flip Flop

-**Counters**: Asynchronous Counters/Ripple Counter (2 bit, 3-bit, Decade)

: Synchronous Counters (2-bit, 3-bit, decade synchronous counter), Ring Counter

Shift Registers: Concept of Shift registers, Types of Shift registers (SISO, SIPO, PISO, PIPO and Universal Shift Registers)

- Applications of Flip-Flops, Counters & Shift Registers

7. Memories **03 hrs**

Classification of Memories RAM, ROM, PROM, EPROM, E2PROM, Cache Memory, Static and Dynamic RAM

8. D/A & A/D Converters **05 hrs**

- Digital to Analog Converters (Weighted register, R-2R Ladder D/A Converter)

-Analog to Digital Converter (Dual Slope method, Successive Approximation A/D Converter)

- Applications of A/D & D/A Converter

LIST OF PRACTICAL

1) Verification of truth table of various logic gates (NOT, OR, AND, NAND, NOR, EXOR) using logic circuit ICs and breadboard.
2) To verify Universal property of NAND and NOR gates.
3) Verification of De-Morgan's theorem.
4) To design and implement Half adder Circuit.
5) To design and implement Full adder Circuit.
6) Implementation of Multiplexer/Demultiplexure using Logic gates.
7) Construction of 7-segment decoder driver circuit.
8) Verification of State Table for RS, JK, D & T Flip-Flops.
9) Design and verify 2 or 3-bit Synchronous counter.
10) Design and verify 2 or 3-bit Asynchronous counter.

RECOMMENDED BOOKS

1. Digital Principles and Applications by Leach & Malvino, Tata McGraw Hill Publicatiom
2. Modern Digital Electronics by R. P. Jain, Tata McGraw Hill Publications
3. Fundamentals of Digital Circuits by A. Anand Kumar, PHI Publications
4. Digital Electronics by Vipan Arora, Eagle's Publication Jullundhar
5. Digital Electronics by Pratima Manhas & Shaveta Thakral, KATSON Publication, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Chapter No	Time Allotted	Marks Allotted %age
1	05	05
2	09	15
3	11	15
4	07	10
5	09	15
6	15	25
7	03	05
8	05	10
Total	**64**	**100**

4.6 COMPUTER PROGRAMMING AND APPLICATIONS

L	T	P
-	1	2

(NO THEORY EXAM, ONLY PRACTICAL EXAM)

RATIONALE

Computer plays a very vital role in present day life, more so, in the professional life of Diploma engineers. In order to enable the students use the computers effectively in problem solving, this course ofers the modern programming language C along with exposure to various engineering applications of computers. The knowledge of C language will be reinforced by the practical exercises and demonstration of application software in the field of Electrical Engineering during the course of study. Introduction to data base management system is also a very significant field with vast employment potential.

DETAIL CONTENTS

1. **Algorithm and Program Development** (4 hrs)

   a) Steps in development of a program
   b) Flow-charts, algorithm development
   c) Introduction to various computer languages
   d) Concept of interpreter, compiler, high level language(HLL), machine language (ML) and Assembly Language

2. **Program Structure (C Programming)** (7 hrs)

   a) History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associatively
   b) I/O statements: Assignment, Variables, arithmetic operation- their precedence, data types standard I/O function, formulated I/O
   c) Control Statements: Logical and relational operators; if-else, while, do- while, for loops, breaks, switch statements
   d) Functions: Function declaration, parameter passing- by value, storage classes (Local, Global and Static variables, standard library functions
   e) Arrays: Single and multi-dimensional arrays, character arrays
   f) Pointers: To various data types, pointers in parameters passing, pointers to function
   g) Structures: Definition of a structure, pointer to structure, union and array of

structure

h) Strings: String processing, functions and standard library function

i) Data files: File handling and manipulation, file reading and writing.

3. **Software Applications in Electrical & Electronics Engineering** (5 hrs)

Overview of Computer applications through various applications software related to Electrical Engineering branch viz: MATLAB, E-CAD, and Circuit Maker.

LIST OF PRACTICALS

1. Programming exercise on executing and editing a C Programs.
2. Programming exercise on defining variables and assigning values to variables
3. Programming exercise on arithmetic and relational operators
4. Programming exercise on reading & writing a character
5. Programming exercise on formatting output using printf
6. Programming exercise on formatting input using scanf
7. Programming exercise on simple IF statement
8. Programming exercise on IF… ELSE statement
9. Programming exercise on SWITCH statement
10. Programming exercise on GOTO statement
11. Programming exercise on DO-WHILE statement
12. Programming exercise on FOR statement
13. Basic commands in MATLAB with simple exercises
14. E-CAD exercise

INSTRUCTIONAL STRATEGY

This course is a highly practical and C. self-study oriented courses. The teachers are expected to explain the theoretical part and ensure that the students execute and debug different programs.

RECOMMENDED BOOKS

1. Programming in C by Schaum Series McGraw Hill
2. Programming in C by Kerning Lan and Richie; Prentice Hall of India, New Delhi
3. Programming in C by Balaguru Swamy, Tata McGraw Hill, New Delhi.
4. Let us C-Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++

6. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
7. Elements of C by MH Lewin, Khanna Publishers, New Delhi
8. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi
9. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers by Rudra Pratap Singh, Oxford Publication
10. The essentials of Computer Organizing and Architecture by Linda Null and Julia Labur, Narosa Publishing House Pvt. Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted(Hrs)	Marks Allocation
1.	Algorithm and Program	04	20
2.	Program Structure (C)	07	60
3.	Software Applications	05	20
Total		**16**	**100**

4.7 ELECTRICAL WORKSHOP PRACTICE-II

L - T - P

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RATIONALE

An electrical diploma holder will be required to inspect, test and modify the work done by skilled workers or artisans working under him. In addition to these persons, many a times, it will become necessary for him to demonstrate the correct method and procedure of doing a job. In order to carry out this function effectively in addition to conceptual understanding of the method or procedure he must possess appropriate manual skills. The subject aims at developing special skills required for repairing, faultfinding, wiring in electrical appliances and installations.

DETAIL CONTENTS

1. Field study of pipe/plate/chemical earthing for a small house and 3-phase induction motor.
2. Testing the condition of earthing using earth tester in an electrical installation.
3. Connections of Single phase and 3-phase motors through appropriate starters and to change their direction of rotation of motor.
4. Study and testing of armature, commutator (with growler) and field pole winding of Mixer Motor, Drill Machine.
5. Wiring, testing and fault finding of the following contactor control circuits operating on 3-phase supply:
    a) Remote control circuits
    b) Automatic star-delta starter using TDR
    c) Inter locking circuits (Forward/Reversed)
    d) Sequential operation control circuits

    Also make the ladder diagram of control circuit of each exercise and interpret the function of each component in ladder diagram

6. Winding/re-winding of a fan (ceiling and table)
7. Power cable jointing using epoxy based joint kits
8. Procedure of laying of underground cables.
9. Testing of an Inverter at its rated load and verification of its backup Hours according to specification, batteries Ampere-hour and grouping to increase backup Hrs.

Note: Students can be taken to field visit to any construction site where earthing work and underground cables laying work is in progress.

RECOMMENDED BOOKS

1. Electrical Workshop: A Text Book by R. P. Singh, I. K. International Publishing House
2. Workshop Practices in Electrical Engineering by M. L. Gupta, Metropolitan Book Company.
3. Electrical Engineering Drawing-I by Surjit Singh, KATSON Publications New Delhi.
4. Electrical Engineering Drawing-II by Surjit Singh, KATSON Publications New Delhi
5. My Electrical Workshop by Thomton Addyman, The Wireless Press