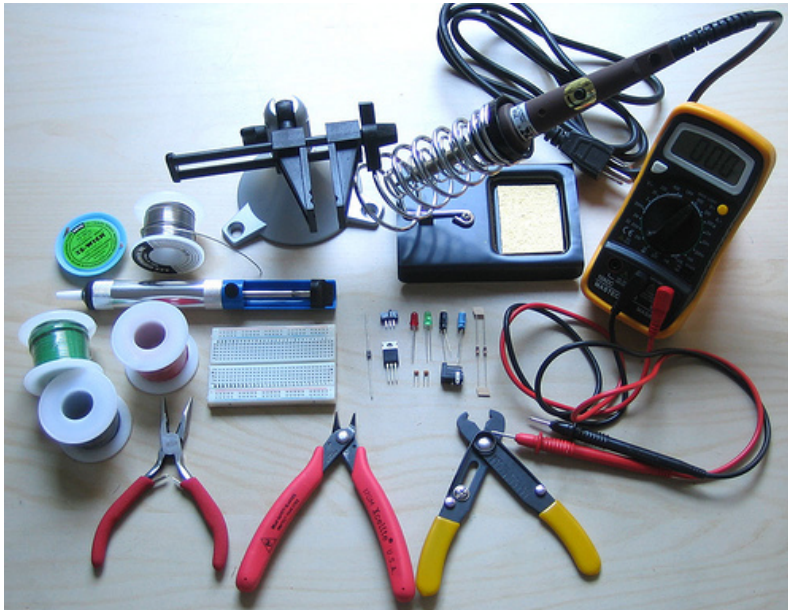
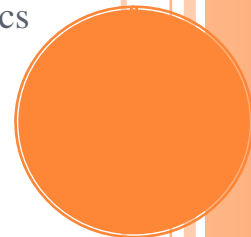


BABA FARID GROUP OF INSTITUTIONS



“Electronics is one of the largest and fastest growing field. It covers a wide range of applications which make our life easier and enjoyable such as Television, Radio, Computers, Telecommunication etc. They help us to see, hear and communicate over vast distances and do things faster. Electronics has a major role in improving productivity in industries like oil, energy, agriculture and so many other important sectors of economy. In steel, petroleum and chemical industries it is the electronic devices that direct, control and test production processes. Health care industry depend on electronic instruments to perform chemical tests and to check body functions. The safety in transportation, factories and mines and in homes relies heavily on electronics. The uses are endless. You must find new solutions to the practical problems affecting our daily lives. You may team with other specialists to design, fabricate, produce, test and supervise the manufacture of complex products and systems i.e electronic equipments and components for a number of industries including hospitals, computer industry, electronic data processing systems for communication and in defense etc after completion of course. Electronics is a constantly changing and widening branch among profession courses.”

--Dr. Subhash Pokhriyal
In-Charge
Department of Electronics



ENGLISH AND COMMUNICATION SKILLS - II

L T P
3 - 2

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a communication skill laboratory for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Facets of Literature | (14 hrs) |
| | 5.1 Short stories | |
| | 1.1.1 The Portrait of a Lady - Khushwant Singh | |
| | 1.1.1 The Doll's House – Katherine Mansfield | |
| | 1.1.2 The Refugees – Pearl S. Buck | |
| | 1.2 Prose | |
| | 1.2.1 Walking Tours – R.L. Stevenson | |
| | 1.2.2 A Dialogue on Civilization – C.E.M. Joad | |
| | 1.2.3 The Sign of Red Cross – Horace Shipp | |
| | 3 Poems | |
| | 1.3.1 All The World's A Stage – W. Shakespeare | |
| | 1.3.2 Say Not, The Struggle Nought Availeth – A.H. Clough | |
| | 1.3.3 Pipa's Song – Robert Browning | |
| 2. | The Art of Précis Writing | (04 hrs) |
| 3. | Grammar and Usage | (08 hrs) |
| | 3.1 Narration | |
| | 3.2 Voice | |
| | 3.3 Idioms and Phrases | |
| 4. | Correspondence | (04 hrs) |

- | | | |
|-----|--|----------|
| 1.1 | Business Letters | |
| 1.2 | Personal letters | |
| 5. | Drafting | (06 hrs) |
| 1.1 | Report Writing | |
| 1.2 | Inspection Notes | |
| 1.3 | Memos, Circulars and Notes | |
| 1.4 | Telegrams | |
| 1.5 | Press Release | |
| 1.6 | Agenda and Minutes of Meetings | |
| 1.7 | Applying for a Job | |
| 6. | Glossary of Technical & Scientific Terms | (04 hrs) |
| 7. | Communication | (08 hrs) |
| 7.1 | Media and Modes of Communication | |
| 1.2 | Channels of Communication | |
| 1.3 | Barriers to Communication | |
| 1.4 | Listening Skills | |
| 1.5 | Body language | |
| 1.6 | Humour in Communication | |

LIST OF PRACTICALS

1. Practice on browsing Information on Internet
2. Group Discussions
3. Mock Interviews
4. Telephone Etiquette-demonstration and practice
5. Situational Conversation with feedback through video recording
6. Presentation on a given theme (using PowerPoint)
7. Exercises leading to personality development like mannerism, etiquettes, body language etc.
8. Reading unseen passages
9. Writing (developing) a paragraph
10. Exercises on writing notices and telephonic messages

Note:

1. The Text Book on "English and Communication Skills, Book-II by Kuldip Jaidka et. al. developed by NITTTTR, Chandigarh is recommended to be used for teaching and setting-up the question papers.
2. A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDs and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.
3. Elements of body language will be incorporated in all practical exercises.

4. The practical exercises involving writing may also be included in Theory Examination.

RECOMMENDED BOOKS

1. English and Communication Skills, Book-II By Kuldip Jaidka, Alwainder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh & Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
2. Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons
3. The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India
4. New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
5. New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
6. A Practical English Grammar by Thomson and Marlinet
7. Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill
8. English Conversation Practice by Grount Taylor; Tata McGraw Hill
9. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
10. Business Correspondence and Report Writing by RC Sharma and Krishna Mohan; Tata McGraw Hill Publishing Company Ltd. New Delhi
11. Communication Skills by Ms R Datta Roy and KK Dhir; Vishal Publication, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1	Facets of Literature	14	30
2	The Art of Précis Writing	4	10
3	Grammar and its Usage	8	15
4	Correspondence	4	10
5	Drafting	6	15
6	Glossary of Technical & Scientific Terms	4	05
7	Communication	8	15
Total		48	100

APPLIED MATHEMATICS – II

L T P
5 - -

RATIONALE

Applied mathematics forms the backbone of engineering studies. In continuation to the basic elements of Differential calculus and integral calculus taught in I paper and their applications, statistics and probability have been included in this course. This course will develop analytical abilities amongst the students and will provide base for continuing education base to the students.

DETAILED CONTENTS

1. Algebra (16 hrs)
 - 1.1 Matrix: Algebra of matrices, inverse, elementary row/column-transformation, linear dependence, rank of matrix, type of matrix, Eigen pairs, Cayley-Hamilton theorem
 - 1.2 Determinants: Elementary properties of determinants of order of 2&3, multiplication system of algebraic equation, consistency of equation, Cramme's rule
 - 1.3 Vector Algebra: Definition of vector and scalar quantities, addition and substration of rectors. Dot and cross product of two vectors. Angle between two vectors, applications of dot and cross product in Engineering problems.

2. Co-ordinate Geometry (16 hrs)
 - 1.2 Point in space. Distance between two points, ratio
 - 1.3 Straight line, finding the equation of straight line, shortest distance between two points
 - 1.4 Plane
 - 1.5 Sphere in space

3. Differential Calculus (16 hrs)
 - 1.2 Successive differentiation. Libnez's theorem
 - 1.3 Partial differentiation: Partial derivatives, total differential co-efficient, chain rule. Euller's theorem of homogeneous function, Jacobians, curl, gradience and divergent and some identities among them.
 - 1.4 Differential equation: Order, degree and meaning of solution of differential equations. Linear, non-linear differential equation, first order equation (separable forms, linear and Bernoulli's form, exact equation and their solutions), second order linear equations (linear equations with constant co-efficients homogeneous and non-homogeneous equation, equations reducible to linear form with constant co-efficients)

4. Integral Calculus (18 hrs)

- 1.2 Laplace transform, solution of differential equation by Laplace transform
- 1.3 Beta and gamma function
- 1.4 Fourier series

5. Statistics and Probability (14 hrs)

- 10.2 Measure of central tendency: Mean, median, mode, mean derivation, standard deviation, rank and rank correlation
- 10.3 Probability: Law of probability and conditional probability
- 10.4 Binomial distribution and Poisson distribution
- 10.5 Continuous and normal distribution
- 10.6 Curve fitting by least square method

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi.
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Applied Mathematics by Dr. RD Sharma
4. Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
5. Comprehensive Mathematics, Vol. I & II by Laxmi Publications
6. Engineering Mathematics by Dass Gupta
7. Engineering Mathematics by C Dass Chawla, Asian Publishers, New Delhi
8. Comprehensive Mathematics, Vol. I & II by Laxmi Publications
9. Engineering Mathematics, Vol I, II & III by V Sundaram et.al, Vikas Publishing House (P) Ltd., New Delhi
10. Engineering Mathematics by N.Ch.S.N Iyengar et.al, Vikas Publishing House (P) Ltd., New Delhi
11. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
12. Engineering Mathematics, Vol I & II by AK Gupta, Macmillan India Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1	Algebra	16	20
2	Co-ordinate Geometry	16	20
3	Differential Calculus	16	20
4	Integral Calculus	18	25
5	Statistics and Probability	14	15
Total		80	100

APPLIED PHYSICS – II

L T P
4 - - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims at giving an understanding of this world both by observation and prediction in which objects will behave. Concrete uses of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

DETAILED CONTENTS

1. Classification of materials (4 hrs)

Classification of materials into Conducting materials, Insulating materials, semiconducting materials with reference to their atomic structure, magnetic material (para, dia and ferro)
2. Fundamentals of D.C. & A.C. (8 hrs)
 - 1.2 D.C: Electric current, Ohm's Law, Series and parallel combination of resistances, Kirchoff's law and their simple applications. Principle of Wheatstone's bridge and its application in meter bridge and post office box
 - 1.3 A.C: Sinusoidal current and EMF. Peak, r.m.s values, inductive, capacitive, reactances, impedance
3. Moving Charge & Magnetic Field (10 hrs)

Magnetic behaviour of current carrying conductor; Magnetic behaviour of current carrying solenoid; concept of Magnetic Field: Magnetic line of forces; force on a current-carrying conductor in a magnetic field; Fleming's Left hand rule; force on a charge moving in a magnetic field; motion of charged particles in a magnetic field; Magnetic field due to a current carrying conductor (Biot-Savart law); Force between two parallel current carrying conductors.
4. Modern Physics (12 hrs)

Laser- Absorption and emission of energy by atom, spontaneous and stimulated emission, Population inversion, Main component of Laser and types of Laser: Ruby Laser, He, Ne and semiconductor Laser and their applications. Super Conductivity- Phenomenon of super conductivity, effect of magnetic field, critical field, type I & type II super conductors and their applications. Radioactivity, nuclear stability, radio active emission, radiation damage, concept of nuclear fission and fusion.
5. Application of Optics: (6 hrs)
 - 1.2 Concept of interference
 - 1.3 Optical slide film projector (principle and operation)

- 1.4 Introduction to fibre, optical fibre materials, types, light propagation and applications
- 1.5 Critical angle, total internal reflection, optical sensor
6. Semi Conductor Physics and its Application (12 hrs)
- Energy band in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, PN junction formation, barrier voltage, forward and reverse biasing of a junction diode, PN junction device characteristics, formation of transistor, transistor action, base, emitter and collector currents and their relationship, LEDs, photoelectric effect and photo devices and their applications..
7. Non Conventional Energy Sources (12 hrs)
- 7.1 Wind Energy: Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, India's wind energy programme.
- 7.2 Solar Energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, solar constant measurement of solar radiation by Pyrometer, and by Insolation meter (Suryamapi) uses of solar energy: solar cooker, solar water heater, solar photovoltaic cells, solar energy collector, solar by planets in India, Modern applications in technology (Qualitative only).

LIST OF PRACTICALS

1. Determination of Resistivity of a given material through P.O.Box.
2. Determination of Resistivity of a given material through Meter Bridge.
3. To verify the Laws of Series and Parallel combination of resistances by P.O.Box
4. To verify the Laws of Series and Parallel combination of resistances by Meter Bridge.
5. Demonstration of He, Ne Laser (Interferometer)
6. To draw the characteristics of transistor
7. Verification of Ohm's law.
8. Verification of Kirchoff's laws.
9. Conversion of Galvano meter into ammeter & Voltmeter.
10. To Draw the characteristics of PN Junction Diode & Determination of Static & Dynamic Resistance.
11. Measurement of solar intensity with the help of Insolation meter (suryamapi)/Lux meter

RECOMMENDED BOOKS

1. Applied Physics Vol. II, TTTI Publication Tata McGraw Hill, New Delhi

1. Basic Applied Physics by RK Gaur; Dhanpat Rai and Co . New Delhi
3. Comprehensive Practical Physics - Volume I and II by JN Jaiswal; Laxmi Publishers
4. Numerical Problems in Physics - Volume I and II by RS Bharaj; Tata McGraw Hill, New Delhis
5. Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
6. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
7. A Text Book of Optics by Subramanian and Brij Lal
8. Physics Laboratory Manual by PK Palanisamy, Scitech Publications
9. Fundamentals of Physics by Resnick and Halliday, Asian Books Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Classification of materials	4	05
2.	Fundamentals of D.C. & A.C.	8	10
3.	Moving Charge and Magnetic Field	10	15
4.	Modern Physics	12	20
5.	Application of Optics	6	10
6.	Semiconductor Physics and its application	12	20
7.	Non Conventional Energy Sources	12	20
Total		64	100

APPLIED CHEMISTRY-II

L T P
2 - 2

RATIONALE

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behaviour when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Metallurgy | (06 hrs) |
| | 7.2 A brief introduction of the terms: Metallurgy, mineral, ore, gangue or matrix, flux, slag, concentration (methods of concentrating the ores), roasting calcination and refining as applied in relation to various metallurgical operations | |
| | 7.3 Metallurgy of (i) Aluminium (ii) Iron with their physical and chemical properties and uses | |
| | 7.4 Definition of an alloy, purposes of alloying, composition and uses of alloys-brass, bronze, magnalium, duralumin, alnico, invar and stainless steel | |
| 2. | Fuels | (08 hrs) |
| | 7.5 Definition of a 'Fuel', characteristics of a good fuel and classification of fuels with suitable examples | |
| | 7.6 Definition of Calorific value of a fuel and its determination for a solid fuel with the help of Bomb calorimeter. | |
| | 7.7 Merits of gaseous fuels over those of other varieties of fuels | |
| | 7.8 Manufacture, composition, properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) Compressed Natural gas (CNG) | |
| | 7.9 Octane Number and Cetane Number | |
| 3 | Corrosion | (04 hrs) |
| | 3.1 Meaning of the term 'corrosion' and its definition | |
| | 3.2 Theories of corrosion i.e. (i) direct chemical action theory and (ii) electro chemical theory | |

- 3.3 Prevention of corrosion by
 (a) Alloying
 (b) Providing metallic coatings
 (c). Sacrificial cathodic protections:
- 4 Lubricants (04 hrs)
- 4.1 Definition of (i) lubricant (ii) lubrication
- 4.2 Classification of lubricants
- 4.3 Principles of lubrication
 (i) fluid film lubrication
 (ii) boundary lubrication
- 1.5 Characteristics of a lubricant such as viscosity, viscosity index, volatility, oxidation, oiliness, acidity, emulsification, flash point, fire point and pour point.
- 1.6 Importance of additives in lubricants
- 5 Cement and Glass (02 hrs)
- 1.2 General introduction to cement and glass
- 1.3 Manufacture of Portland Cement
- 1.4 Manufacture of ordinary glass and lead glass
6. Classification and Nomenclature of Organic Compounds (08 hrs)
- Classification of Organic Compounds, functional group, Homologous Series, Nomenclature, Physical and Chemical properties, and industrial use of Organic Compounds, IUPAC system of nomenclature of Carboxylic acid, Alcohols, Phenols, Aldehydes, Ketones and Amines.

LIST OF PRACTICALS

5. Gravimetric analysis and study of apparatus used there in
6. To determine the percentage composition of a mixture consisting of a volatile and a non-volatile substances
2. Estimate the amount of moisture in the given sample of coal
3. Estimate the amount of ash in the given sample of coal
4. Esterification and ceric ammonium tests of alcohol
5. Solium carbonate and Ester test of carboxylic acids

6. To determine the amount of copper in the given sample of copper sulphate with the help of N/20 sodium thiosulphate solution.
7. Detection of metal ions in the rust solution (Rust in concentrated HCL may be given)
8. Demonstration – to determine calorific value of a solid fuel with the help of Bomb Calorimeter

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, New Delhi
2. Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra ; Kumar and Kumar Publishers (P) Ltd. Bangalore-40
3. A Text Book of Applied Chemistry-II by SS Kumar; Tata McGraw Hill, Delhi
2. A Text Book of Applied Chemistry-II by Sharma and Others; Technical Bureau of India, Jalandhar
3. Engineering Chemistry by Jain PC and Jain M,
4. Chemistry of Engineering by Aggarwal CV,
5. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi
6. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1	Metallurgy	6	15
2	Fuels	8	25
3	Corrosion	4	20
4	Lubricants	4	20
5	Cement and Glass	2	10
6.	Classification and Nomenclature of Organic Compounds	8	10
Total		32	100

ENGINEERING DRAWING – II

(common with Civil, Electrical and Mechanical Engineering)

L T P
- - 6

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

- Note(s):
1. First angle projection is to be followed
 2. Minimum of 15 sheets to be prepared by each student
 3. SP 46 – 1988 should be followed
 4. Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students

DETAILED CONTENTS

1. Development of Surfaces (2 sheets)
Development of surfaces – cubes, prisms, (square, pentagonal and hexagonal), cylinders, pyramids (square, pentagonal, hexagonal) and cones
2. Detail and Assembly Drawing (2 sheets)
 - 2.1 Principle and utility of detail and assembly drawings
 - 2.2 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortise and Tenon joint
3. Threads (2 sheets)
 - 1.2 Nomenclature of threads, types of threads (metric), single and multiple start threads
 - 1.3 Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, Buttress Threads
 - 1.4 Simplified conventions of left hand and right hand threads, both external and internal threads
4. Locking Devices (1 sheet)
Lock nut, castle nut, split pin nut, sawn nut, slotted nut
5. Nuts and Bolts (3 sheets)
Different views of hexagonal and square nuts; Assembly of hexagonal headed, square headed, square headed with square neck, bolts with hexagonal and square nuts and washers. Foundations bolts – Rag bolt and Lewis bolt
6. Screws, Studs and Washers (1 sheet)
 - 6.1 Drawing various types of machine screws

- 6.2 Drawing various types of studs and set screws
- 7. Keys and Cotters (2 sheets)
 - 1.2 Various types of keys and cotters and their practical application and preparation of drawing of various keys and cotters showing keys and cotters in position
 - 7.2 Cotter joints (i) gib and cotter joint (ii) knuckle joint
- 8. Rivets and Riveted Joints (2 sheets)
 - 8.1 Types of structural and general purposes rivet heads
 - 8.2 Caulking and fullering of riveted joints
 - 8.3 Types of riveted joints – lap, butt (single riveted, double riveted lap joint, single cover plate and double cover plate), chain and zig – zag riveting
- 9. Welded Joints (1 sheet)
 - 9.1 Various conventions and symbols of welded joints (IS 696)
 - 9.2 Practical applications of welded joints say joints on steel frames, windows, doors and furniture
- 10. Couplings (2 sheets)
 - 1.2 Muff or Box coupling, half lap muff coupling
 - 10.2 Flange coupling (Protected and non-protected)
 - 10.3 Flexible coupling
- 11. AutoCAD (for practicals and viva only)
 - 11.1 Practice on drawing commands, editing commands
 - 11.2 Practice on sectioning and hatching
 - 11.3 Practice on preparing simple drawings

RECOMMENDED BOOKS

1. Elementary Engineering Drawing by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh, Dhanpat Rai and Co. Delhi
2. Engineering Drawing by PS Gill, SK Kataria and Sons, New Delhi
3. Machine Drawing by RB Gupta, Satya Prakashan, New Delhi.

Note:

- a. Minimum 15 drawing sheets will be prepared by the students
- b. No marks are suggested; instead it is emphasized that the examination paper should contain exercises for evaluation of all necessary skills envisaged in the curriculum.
- c. It is also suggested that an external examiner should conduct a comprehensive viva of each students during or just after the examinations to ascertain understanding of the subject e.g. reading and interpreting drawing and development of necessary skills etc.

COMPUTER PROGRAMMING AND APPLICATIONS IN ELECTRICAL ENGINEERING

L T P
2 - 3

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 offers 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.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Algorithm and Program Development | 4 hrs) |
| | <ul style="list-style-type: none"> 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) | (24 hrs) |
| | <ul style="list-style-type: none"> a) History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associativity 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, Binary and ASCII files, file records using standard function type mouse
1. Software Applications in Electrical Engineering (4hrs)
- Computer application overview through various applications software related to Electrical Engineering branch viz: MATLAB, PSIM, MULTISIM, PSPICE in Electrical Engineering

LIST OF PRACTICALS

1. Programming exercise on executing a C Programs.
2. Programming exercise on editing a C program.
3. Programming exercise on defining variables and assigning values to variables
4. Programming exercise on arithmetic and relation operators
5. Programming exercise on arithmetic expressions and their evaluation
6. Programming exercise on reading a character
7. Programming exercise on writing a character
8. Programming exercise on formatting input using print
9. Programming exercise on formatting output using scan
10. Programming exercise on simple IF statement
11. Programming exercise on IF... ELSE statement
12. Programming exercise on SWITCH statement
13. Programming exercise on GOTO statement
14. Programming exercise on DO-WHILE statement
15. Programming exercise on FOR statement
16. Programming exercise on one dimensional arrays
17. Programming exercise on two dimensional arrays
18. Demonstration of Application software to Electrical Engineering branch such as: MATLAB, PSIM, MULTISIM, PSPICE in Electrical Engineering

INSTRUCTIONAL STRATEGY

This course is a highly practical and self- study oriented courses. The teachers are expected to explain the theoretical part and make the students to execute and debug different programs. The PC needed to have either Turbo C.

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 R Subburaj, Vikas Publishhing House Pvt. Ltd., Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi
10. The Complete Reference to Visual Basic 6, by Noel Jerke, Tata McGraw Hill, New Delhi
1. Web site www.Beyondlogic.org
12. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi
13. Programming in Applications by Chandershekhar, Unique International Publications, Jalandhar
14. 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 Development	4	15
2.	Program Structure (C Programming)	24	70
3.	Software Applications	4	15
Total		32	100

GENERAL WORKSHOP PRACTICE - II

(Common with Civil, Electrical, Eltx, and Mechanical Engineering)

L T P
- - 6

RATIONALE

Manual abilities to handle engineering materials with hand tools need to be developed in the students. This course aims at developing generic manual and machining skills in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides above, the development of dignity of labour, precision, safety at work places, team working and development of right attitude are other objectives.

DETAILED CONTENTS

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

PRACTICAL EXERCISES

The following shops are included in the syllabus :

1. Carpentry and Painting shop-II
2. Fitting and Plumbing shop-II
3. Welding shop-II
4. Electric shop-II
1. Forging shop
2. Machine shop

1. Carpentry and Painting Shop-II

- 1.1 Introduction to joints, their relative advantages and uses.
 - Job I Preparation of Dovetail joint and glued joint.
 - Job II Preparation of Mitre Joint
 - Job III Preparation of a lengthening Joint
 - Job IV Preparation of at least one utility job with and without lamination.
- 1.2 Demonstration of job showing use of Rip Saw, Bow saw and Trammel, method of sharpening various saws.
- 1.3 Demonstration of job on Band Saw and circular saw, universal wood working machine, saw resharpening machine, Saw Brazing unit.
- 1.4 Importance and need of polishing wooden items, Introduction to polishing materials.
 - Job V Preparation of surface before polishing.

- Job VI Application of primer coat.
- Job VII Polishing on wooden items.

2. Fitting and Plumbing Shop-II

- 2.1 Description and demonstration of various types of drills, taps and dies
- 2.2 Selection of dies for tapping. Types of taps, tapping, dieing and drilling operations.
 - Job I Making internal and external threads on a job by tapping and dieing operations (manually)
- 2.3 Precautions while drilling soft metals, specially aluminum and lead.
 - Job II Drilling practice on soft metals (Aluminum, Brass and lead)
- 2.4 Care and maintenance of measuring tools like calipers, steel rule, try square, vernier, micrometer, height gauge, combination set, reading gauge. Handling of measuring instruments, checking of zero error, finding of least count.
 - Job III Preparation of a job by filing on non-ferrous metal.
 - Job IV Production of a utility job involving all the above operations.
 - Job V Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow T - Union, socket, stopcock, taps, etc
- 2.5 Description and demonstration of various types of drills, taps and dies; Selection of dies for tapping; Types of taps, Tapping and dieing operations.

3. Welding Shop-II

- 3.1 Introduction of the gas welding, gas welding equipment, adjustments of different types of flames, demonstration and precautions about handling welding equipment.
 - Job I Practice in handling gas welding equipment and welding practice.
- 3.2 Common welding joints generally made by gas welding.
 - Job II Preparation Butt joint by gas welding.
 - Job III Preparation of small cot conduit pipe frame by electric arc welding/gas welding.
 - Job IV Preparation of square pyramid from M.S rods by welding (type of welding to be decided by students themselves).
 - Job V Exercise job on spot/seam welding machine.

4. Electric Shop-II

- 4.1 Importance of three phase wiring and its effectiveness.
 - Job I Laying out 3 phase wiring for an electric motor or any other 3 phase machine.
- 4.2 Estimating and costing power consumption.
 - Job II Connecting single phase energy meter and testing it. Reading and working out the power consumption and the cost of energy.
 - Job III Checking continuity of connection (with tester and bulbs), location of faults with a multimeter and their rectification in simple machines and/or other electric circuits fitted with earthing.
- 4.3 Demonstration of dismantling, servicing and reassembling of a table fan/ceiling fan/air cooler/mixer/electric iron, Electric heater, geaser, electric oven etc.

Job IV Dismantling, serving and reassembling of any of the above electrical appliances.

Job V Demonstration of testing single phase/three phase electrical motor by using voltmeters ammeter clip on meter technometer etc.

Job VI Reversing the rotation of motor.

5. Forging Shop

Introduction to forging, forging tools, tongs, blowers/pressure blowers, hammers, chisels, punch, anvil, swage-block etc. Forging operations.

Job I Forge a L hook or ring from MS rod 6 mm ϕ

Job II Forge a chisel and give an idea of hardening and tempering

Job III Lap joint with forge welding

Job IV High Strength Steel tools – forging of lathe and shaper tools

6. Machine Shop

Introduction to various machines used in machine shop.

Job I Exercise on simple turning

Job II Exercise on taper turning

Job III Marking and drilling practice on mild steel piece

Job IV Marking and drilling practice on aluminium piece

Job V Demonstration of various functions of CNC Machine

RECOMMENDED BOOKS

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana and P Kaunaioh; MacMillan India Ltd., New Delhi
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

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 eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

The camp may be organized at a stretch for 3 to 4 days. During the camp, experts from various organizations/institutes etc. may be invited to deliver lectures on ecology and environmental issues. The students may be encouraged to read papers or give seminar during the camp on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods
8. Mining, blasting, deforestation and their effects
9. Legislation to control environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

L T P
4 - -

RATIONALE

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.

DETAILED CONTENTS

1. Classification: (3 Hrs)
 Classification of material into conducting, semi conducting and insulating materials through a brief reference to their atomic structures and energy bands
2. Conducting Materials (12 Hrs)
 - 2.1 Introduction
 - 2.2 Resistance and factors affecting it such as alloying and temperature etc
 - 2.3 Superconductor
 - 2.4 Classification of conducting material as low resistivity and high resistivity materials
 Low resistance materials
 - 2.4.1 Copper:
 Its general properties as conductor, resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering.
 - 2.4.2 Aluminium:
 General properties at conductor, resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solderability, contact resistance. Applications in the field of electrical engineering.
 - 2.4.3 Steel:
 General properties at conductor, resistivity, corrosion, temperature coefficient, density, mechanical properties, solderability, Applications in the field of electrical engineering.

- 2.4.4 Introduction to bundle conductors and its applications.
- 2.4.5 Low resistivity copper alloys: Brass, Bronze their practical applications with reasons for the same
- 2.5 Applications of special metals e.g. Silver, Gold, Platinum etc.
- 2.6 High resistivity materials and their applications e.g., manganin, constantin, Nichrome, mercury, platinum, carbon and tungsten
- 2.7 Superconductors and their applications
- 3. Semi-conducting Materials (8 Hrs)
 - 3.1 Introduction
 - 3.2 Semi-conductors and their properties
 - 3.3 Different semi-conducting materials (silicon and germanium) used in manufacture of various semiconductor devices (i.e p-type and n-type semiconductors)
 - 3.4 Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.
- 4. Insulating materials; General Properties: (12 Hrs)
 - 4.1 Electrical Properties:
Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant
 - 4.2 Physical Properties:
Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness
 - 4.3 Thermal Properties:
Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics
 - 4.4 Chemical Properties:
Solubility, chemical resistance, weather ability
 - 4.5 Mechanical properties, mechanical structure, tensile structure
- 5. Insulating Materials and their applications: (12 Hrs)
 - 5.1 Plastics
 - 5.1.1 Definition and classification
 - 5.1.2 Thermosetting materials:
Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine-formaldehyde), epoxy resins - their important properties and applications
 - 5.1.3 Thermo-plastic materials:

Polyvinyl chloride (PVC), polyethylene, silicones, their important properties and applications

- 5.2 Natural insulating materials, properties and their applications
- Mica and Mica products
 - Asbestos and asbestos products
 - Ceramic materials (porcelain and steatite)
 - Glass and glass products
 - Cotton
 - Silk
 - Jute
 - Paper (dry and impregnated)
 - Rubber, Bitumen
 - Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation
 - Enamels for winding wires
 - Glass fibre sleeves
- 5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF₆ their properties and applications
6. Magnetic Materials: (9 Hrs)
- 6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop (including) coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect.
- 6.2 Soft Magnetic Materials:
- 6.2.1 Alloyed steels with silicon, high silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines
 - 6.2.2 Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine
 - 6.2.3 Nickel-iron alloys
 - 6.2.4 Soft Ferrites
- 6.3 Hard magnetic materials
Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications
7. Special Materials (4 hrs)
Thermocouple, bimetals, lead soldering and fuse material, mention their applications
8. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc (4 hrs)

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 SK Sahdev, Unique International Publications
4. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
5. Electronic Engineering Materials by ML Gupta, Dhanpat Rai and Sons, New Delhi
6. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
7. Electrical & Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
8. Electrical Material science by P.V. Gupta

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Classification	4	5
2.	Conducting Materials	10	15
3.	Semi- conducting Materials	8	15
4.	Insulating Materials: General Properties	12	20
5.	Insulating Materials and their Applications	12	20
6.	Magnetic Materials	10	15
7.	Special Materials	4	5
8.	Introduction of various Engineering Materials	4	5
Total		64	100

BASIC ELECTRICAL ENGINEERING

L T P
4 - 3

RATIONALE

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

DETAILED CONTENTS

1. Applications and Advantages of Electrical Energy (03 hrs)
 - 1.1 Different forms of energy
 - 1.2 Advantages of electrical energy
 - 1.3 Difference between AC and DC
 - 1.4 Uses of electrical energy

2. Basic Electrical Quantities (03 hrs)
 - 2.1 Basic concept of charge, current, voltage, resistance, power, energy and their units
 - 2.2 Conversion of units of work, power and energy from one form to another

3. Batteries (10 Hrs)
 - 2.0 Basic idea about primary and secondary cells
 - 3.0 Working principle, construction and applications of Lead acid battery and Nickel Cadmium cells, Silver Oxide Cells
 - 4.0 Charging methods used for lead acid accumulator
 - 5.0 Care and maintenance of lead acid battery
 - 3.5 Grouping of cells in series and parallel (simple numerical problems).

4. DC Circuits (8 Hrs)
 - 5.3 Ohm's law, resistances in series and parallel
 - 5.4 Kirchoff's laws and their applications in solving electrical network problems
 - 5.5 Network theorems such as theorem and Newton theorem
 - 5.6 Star-delta transformation
 - 5.7 Introduction to constant

5. Magnetism and Electromagnetism and Conversion: (6 hrs)
 - 5.1 Introduction to electromagnetism, Magnetic field around a straight current carrying conductor and a solenoid and methods to find its direction, force between two parallel current carrying conductors.
 - 5.2 Force on a conductor placed in the magnetic field
 - 5.3 Series magnetic circuits, simple problems
 - 5.4 Concept of hysteresis, hysteresis loop and hysteresis loss.

6. Electromagnetic Induction: (8 Hrs)

- 6.1 Faraday's Laws of electromagnetic induction
 - 1.3 Lenz's law
 - 1.4 Fleming's Right and Left Hand Rule
 - 8.1 Principle of self and mutual induction
 - 8.2 Principle of self and mutually induced e.m.f. and simple problems
 - 8.3 Inductances in series and parallel
 - 8.4 Energy stored in a magnetic field
 - 8.5 Concept of eddy currents, eddy current loss
7. AC Fundamentals (18 Hrs)
- 7.1. Concept of alternating current and voltage, equation of instantaneous values
 - 7.2. Representation of alternating sinusoidal quantities by phasors.
 - 7.3. Phasor algebra (addition, subtraction, multiplication and division of complex quantities)
 - 7.4. AC through pure resistance, inductance and capacitance
 - 7.5. Concept of susceptance, conductance and admittance
 - 7.6. Alternating voltage applied to RL, RC and RLC series and parallel circuits (impedance triangle, phasor diagram and their solutions)
 - 7.7. Power in pure resistance, inductance, capacitance, RL, RC, RLC circuits
 - 7.8. Active and reactive components of current and their significance
 - 7.9. Power factor and its practical significance
 - 7.10. Resonance in series and parallel circuits
 - 7.11. j-notation and its application in solving problems in ac circuits
 - 7.12. Active power, reactive Power, apparent power
 - 7.13. introduction to Harmonics and Transients
8. Polyphase systems (8 hrs)
- 2.1 Advantages of 3 phase over single phase system
 - 2.2 Star and delta connections (relationship between phase and line voltages, phase and line currents)
 - 2.3 Power in 3 phase circuits

LIST OF PRACTICALS

1. To verify Ohm's law
2. To verify that $R_t = R_1 + R_2 + \dots$ where R_1, R_2 etc. are resistances connected in series
3. To verify $R_t = \frac{R_1 R_2 R_3}{R_1 + R_2 + R_3}$ Where R_1, R_2 etc. are resistances connected in parallel

4. Verification of Kirchhoff's laws 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 see that algebraic sum of currents at node point is zero
 - d) to see that algebraic sum of e.m.f.s. and voltage drops in a closed loop is zero

5. Filament lamp
 - a) measure the resistance of a cold lamp filament with the help of a multimeter
 - b) measure the current drawn by the lamp at different voltages from zero to 220 volts and the resistance of lamp at different voltages, plot a graph between resistance and voltage and to draw conclusion.

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

7. To construct an R-L series circuit and to measure:
 - (a) impedance (z) of the circuit
 - (b) Inductive reactance (X_L) of the circuit by measuring voltage drop across the inductance dividing it by the current through the circuit
 - c) to verify that impedance $Z = \sqrt{R^2 + X_L^2}$
 - d) to determine phase angle between voltage and current and its power factor
 - e) construct its impedance triangle

9. To construct an RLC series circuit and to measure
 - a) its impedance
 - b) inductive (X_L) and capacitive reactance(X_c)
 - c) verify that $z = \sqrt{R^2 + (X_L - X_c)^2}$
 - d) measure phase angle between voltage and current
 - e) construct impedance triangle

9. Measurement of power and power factor of a single phase RC, RL and RLC circuit. To calculate KVA and KVAR

10. Measurement of power and power factor of a 3 phase circuit by using 2 watt meters. To calculate KVA and KVAR

12. Testing a battery for its discharged condition and to charge it

RECOMMENDED BOOKS

2. Electrical Science by VK Mehta, S Chand & Co., New Delhi
3. Electrical Science by Sahdev, Unique International Publication, Jalandhar
4. Electrical Engineering by DR Arora, Ishan Publications, Ambala
5. Electrical Science by JB Gupta, SK Kataria & Sons, New Delhi
6. Electrical Technology by BL Theraja, S Chand & Co., New Delhi
7. Electrical Science by Trilok Singh, SK Kataria, New Delhi
8. Electrical Science by S. Chandhni, R Chakrabarti and PK Chattopadhyay. Narosa Publishing House Pvt. Ltd., New Delhi
9. Basic Electrical Engineering by Mool Singh, Galgotia Publication Pvt. Ltd., New Delhi
10. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill, New Delhi
11. Principles of Electrical Engineering by BR Gupta, S Chand & Co., New Delhi
12. Handbook of Electrical Engineering by SL Bhatia, Khanna Publishers, New Delhi
13. Electrical Power System by S Channi Singh, McGraw Publishing Co.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Applications and Advantages of Electrical Energy	03	5
2.	Basic Electrical Quantities	03	5
3.	Batteries	10	15
4.	DC Circuits	08	10
5.	Magnetism and Electromagnetism and Conversion	06	10
6.	Electromagnetic Induction	08	10
7.	AC Fundamentals	18	30
8.	Polyphase systems	08	15
Total		64	100

ELECTRONICS - I

L T P
4 - 3

RATIONALE

At present electronics gadgets are being extensively used in manufacturing process in industries, power system operations, communication systems, computers etc. Even for an electrical diploma holder, it is absolutely necessary to have basic understanding of electronics components, their function and applications. This understanding should facilitate in operation and maintenance of equipment, which are electronically controlled.

In this course, topics like electronic components, semi-conductor physics, rectifiers, and amplifiers have been included. The remaining topics are included in electronic devices and circuits.

DETAILED CONTENTS

1. Introduction (5 hrs)
 - 3.2 Brief history of development of electronics
 - 3.3 Active and passive components
 - 3.4 Concept of current and voltage sources, constant voltage and current sources, their graphical representation. Conversion of voltage source into current source and vice-versa
 - 3.5 Difference between actual voltage source and constant voltage source
2. Semi-conductor Theory (10 hrs)
 - 4.1 Atomic structure, crystalline structure
 - 4.2 Energy band theory of crystals, energy band structure of insulator, semiconductor and conductor, generation and recombination. Energy band structure of Silicon and Germanium
 - 4.3 Silicon versus Germanium for mobility and conductivity
 - 4.4 Concept of intrinsic and extrinsic semiconductors
 - 4.5 Effect of temperature on intrinsic and extrinsic semiconductors
3. Semiconductor Diodes (10 hrs)
 - 3.1 PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing and a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism
 - 5.1 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance
 - 5.2 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), relation between DC output and AC input voltage, rectifier efficiency
 - 5.3 Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie () filters and their applications

- 5.4 Diode ratings/specifications
 - 5.5 Various types of diodes such as zener diode, varactor diode, Schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications
 - 5.6 Zener diode and its characteristics
 - 5.7 Use of zener diode for voltage stabilization
4. Bi-polar Transistors (7 hrs)
- 6.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow
 - 6.2 Transistor configurations: common base (CB), Common emitter (CE) and common collection (CC), current relation and their input/output characteristics; comparison of the three configurations
5. Transistor Biasing and Stabilization (10 hrs)
- 7.1 Transistor biasing, its need, operating point and need of stabilization of operating point.
 - 7.2 Difference between circuits, limitations, simple problems to calculate operating point in different biasing circuits. Use of thevenin theorem to determine operating point
 - 7.3 Effect of temperature on the operating point of a transistor
 - 7.4 Concept of h-parameters of a transistor
 - 7.5 Use of data book to know the parameters of a given transistor
6. Single-Stage Transistor Amplifiers (10 hrs)
- 8.1 Single stage transistor amplifier circuit in CE configuration, function of each component
 - 8.2 Working of single stage transistor amplifier, physical and graphical explanation, phase reversal
 - 8.3 Concept of DC and AC load line
 - 8.4 Voltage gain of single stage transistor amplifier using characteristics of the device
 - 8.5 Concept of input and output impedance
 - 8.6 AC equivalent circuit of single stage transistor amplifiers
 - 8.7 Calculation of voltage gain using AC equivalent circuit
 - 8.8 Frequency response of a single stage transistor amplifier
7. Multi-Stage Transistor Amplifiers (7 hrs)
- 1.1 Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications.
 - 1.2 Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width
 - 1.3 RC coupled two-stage amplifiers, circuit details, working, frequency response, applications
 - 1.4 Loading effect in multistage amplifiers

- 1.5 Elementary idea about direct coupled amplifier, its limitations and applications
 - 1.6 Transformer coupled amplifiers, its frequency response. Effect of co-efficient of coupling on frequency response. Applications of transformer coupled amplifiers
8. Field Effect Transistor (FET) (05 hrs)
- 2.1 Construction, operation, characteristics and applications of a N channel JFET and P channel JFET
 - 2.2 JFET as an amplifier
 - 2.3 Construction, operation, characteristics and applications of a MOSFET in depletion enhancement mode
 - 2.4 Comparison between BJT, JFET and MOSFET

LIST OF PRACTICALS

1. a) Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor
- b) Measurement of resistances using multimeter and their comparison with colour code values
2. V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance
3. a) V-I characteristics of a zenor diode and finding its reverse breakdown voltage
- b) Fabrication of a zenor diode voltage stabilizer circuit using PCB
4. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage
5. Observation of input and output wave shapes of a full wave rectifier and verification and relationship between dc and ac input voltage
6. Observation of input wave shape of a full wave rectifier with (i) shunt capacitor (ii) series induction (iii) π filter circuits
7. Plotting input and output characteristics of a transistor in CB configuration
8. Plotting input and output characteristics of a transistor in CE configuration
9. Measurement of operating point in case of (i) fixed biased circuit (ii) potential divider biasing circuit and to observe the effect of temperature variation on the operating point.
10. To measure the voltage gain of a single stage amplifier using CE configuration at different loads
11. To plot frequency response curve of a single stage transistor amplifier using semilog sheet and to measure its band width

12. To measure the voltage gain of a two-stage RC coupled amplifier (a) as individual stages (b) after coupling as multi-stage amplifier (c) to study effect of coupling capacitor on frequency response
13. To plot frequency response curve of a two stage RC coupled amplifier using semi-log sheet and measure the band width
14. To plot V-I characteristics of a FET

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hill, New Delhi
2. Analog Electronics by BP Arora, Ishan Publications, Ambala
3. Electronic Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi
4. Electronic Devices and Circuits by R Boylestead
5. Electronic Devices and Circuits by Ravi Raj Dubey
6. Analog Electronics by JC Karhara, King India Publication, New Delhi
7. Electrical Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
8. Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction	05	10
2.	Semi - conductor Theory	10	15
3.	Semi – conductor Diodes	10	15
4.	Bi-polar Transistor	07	10
5.	Transistor biasing and Stabilization	10	15
6.	Single-Stage Transistor Amplifiers	10	15
7.	Multi-Stage Transistor Amplifiers	07	10
8.	Field Effect Transistor(FET)	05	10
Total		64	100

ELECTRICAL ENGINEERING DESIGN AND DRAWING - I

L T P
- - 6

RATIONALE

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

- a) Read, understand and interpret engineering drawings
- b) Communicate and co-relate ideas about components through sketches and drawings
- c) Prepare working drawings of panels, transmission and distribution lines, wiring installations etc.

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.

DETAILED CONTENTS

1. Symbols and Signs Conventions (4 hrs)

Various Electrical and Electronic Symbols, Electrical Signs Conventions as per BIS Standards,
2. Simple light and Fan Circuits (min 4 Sheets) (20 hrs)

 - 2.1 Lights, Fan power points controlled by individual switches.
 - 2.2 One lamp controlled by two switches (staircase circuit)
 - 2.3 Two lamps controlled by three switches (double staircase circuit)
 - 2.4 Circuit using master switch
 - 2.5 Fluorescent tube controlled from one switch
3. Simple Alarm circuits with and without Relays: (12 hrs)

 - 3.1 One bell controlled by one push button
 - 3.2 Two ordinary bells (for day and night) used at a distant/ residence
 - 3.3 No. of bells controlled by separate switches
 - 3.4 Bell response circuit using bell and relays
 - 3.5 Bell response circuit of an office (for three rooms)
 - 3.6 Traffic light control system for two-road crossing
4. Design and drawing of panels/ distribution board using MCBs, main switch and change-over switch for (24 hrs)
 - domestic loads
 - industrial loads
 - commercial loads

- This includes drawing of installation plan and wiring diagram.
5. Orthographic Projection of Simple Electrical parts (min 5 Sheets) (36 hrs)
- 5.1 Kit -Kat fuse base
 - 5.2 Kit -Kat fuse carrier
 - 5.3 Bus bar post
 - 5.4 Pin type and shackle type insulator
 - 5.5 Bobbins of a small transformer/ choke—data chart must be supplied
 - 5.6 Stay insulators
 - 5.7 M.C.B and E.L.C.B.(Earth Leakage Ckt. Breaker)
 - 5.8 Brush Holder
 - 5.9 Bushing of Transformer
 - 5.10 Knife Switch

INSTRUCTIONAL STRATEGY

Teacher should identify/prepare more exercises on the pattern shown above. The teacher should make the students confident in making drawing and layouts of electrical wiring installations and doing estimation and costing. This capability will lead the students to become a successful entrepreneur. Take the students to field/laboratory and show the material and equipment.

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, Unique International Publications, Jalandhar
5. Electrical Engineering Drawing by Surjit Singh, SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr No.	Topic	Time Allotted(hrs)	Marks Allocation
1.	Symbols and Signs Convention	4	5
2.	Simple Light and Fan Circuits	20	20
3.	Simple Alarm Circuit with and without Relays	12	10
4.	Design and drawing of panels	24	25
5.	Orthographic Projection of simple Electrical parts	36	40
Total		64	100

GENERAL ENGINEERING

L T P
4 - 2

RATIONALE

A diploma holder has to assist in activities of installation, operation and maintenance etc of different machines and equipment. These activities are not branch specific and instead require him to know basics of civil, electrical and mechanical engineering. The subject of General Engineering has been included to impart basic knowledge of civil, electrical and mechanical engineering to the students.

Note:

1. The students of Civil Engineering, will be studying Part A (Mechanical Engineering) and Part B (Electrical Engineering) only.
2. The students of Electrical engineering, Electronics and Communication Engineering, Instrumentation and Control Engineering, Computer Engineering and Information Technology will be studying Part A (Mechanical Engineering) and Part C (Civil Engineering) only.
3. The students of Mechanical Engineering will be studying Part B (Electrical Engineering) and Part C (Civil Engineering) only.
4. The students of remaining branches of engineering and technology will be studying all the three Parts A (Mechanical Engineering), Part B (Electrical Engineering) and Part C (Civil Engineering), unless specified otherwise
5. A time of 2 hours per week has been allotted to Mechanical Engineering, 2 hours per week to Electrical Engineering and 2 hour per week to Civil Engineering in the lecture hours, for teaching theory and a lump-sum time of 2 hours per week has been allotted for the Practical Work.

DETAILED CONTENTS

PART-A

MECHANICAL ENGINEERING

Theory

- | | | |
|-----|--|---------|
| 1. | Transmission of Power | (8 hrs) |
| 1.0 | Belt Drives:
Types of belts, belt materials, cross and flat belt drives, advantages of V-belt drive over flat belt drive. | |
| 2.0 | Gears Drives:
Types of gears (briefly), types of gear trains | |

2. Internal combustion Engines (10 hrs) 16
- 1.0 Classification of IC engines
 - 2.0 Working principles of two stroke and four stroke engines
 - 3.0 Working principles of petrol engine and diesel engines
 - 2.4 Gas turbines (working principle only)
3. Refrigeration and Air Conditioning System (8 hrs)
- 3.1 Different types of refrigeration principles and refrigerants
 - 3.2 Working of domestic refrigerator
 - 3.3 Working of Window type AC system
4. Hydraulics: (6 hrs)
- 4.1 Classification of pumps (reciprocating and centrifugal)
 - 4.2 Working principles of both reciprocating and centrifugal pumps
 - 4.3 Turbine: Working principles of impulse turbine and reaction turbine and their applications

PRACTICAL EXERCISES IN MECHANICAL ENGINEERING

1. Demonstration and study of main parts of 4 stroke petrol and diesel engines by actually dismantling them (The idea is to acquaint the students with the most common troubles occurring in the engines)
2. Demonstration and study of main parts of 2 stroke petrol engine by actually dismantling it. (The idea is to acquaint the students with the most common trouble occurring in the engines)
3. Demonstration and study of gas turbines through models
4. Demonstration and study of different hydraulic pumps
5. Demonstration and study of various drives for transmission of powers i.e. models of belts and gears.
6. Demonstration and study of air conditioning system in a building
7. Demonstration and study of domestic refrigeration system

PART B

ELECTRICAL ENGINEERING

Theory

1. Basic Quantities of Electricity: (4 hrs)
- 1.1 Definition of voltage, current, power and energy with their units

- 1.2 Name of the instruments used for measurement of electrical quantities such as voltmeter, ammeter, wattmeter, energy meter.
- 3.0 Connection of these instruments in electric circuit

- 1. Applications And Advantages of Electricity: (3 hrs)
 - 1.0 Difference between AC and DC
 - 2.0 Various applications of electricity
 - 3.0 Advantages of electrical energy over other types of energy

- 3. Various Types of Power Plants: (3 hrs)
 - 3.1 Elementary block diagram of thermal, hydro and nuclear power stations
 - 3.2 Brief explanation of the principle of power generation in above power stations

- 4. Transmission and Distribution System (6 hrs)
 - 1.0 Key diagram of 3 phase Electrical distribution system
 - 2.0 Brief functions of accessories of distribution line
 - 3.0 Distinction between 11 kV and 415 volt distribution system
 - 4.0 Identification of three phase wires, neutral wires and the earth wire on a low voltage distribution system
 - 5.0 Identification of the voltage between phases and between one phase and neutral
 - 6.0 Distinction between three phase and single phase supply

- 5. Supply from the Poles to the Distribution Board: (4 hrs)
 - 1.0 Arrangement of supply system from pole to the distribution board
 - 2.0 Function of service line, energy meter, main switch, distribution board

- 6. Domestic Installation: (6 hrs)
 - 6.1 Distinction between light and fan circuits and single phase power circuit, sub circuits
 - 1.0 Various accessories and parts of installation, identification of wiring systems
 - 2.0 Common safety measures and earthing
 - 6.4 Introduction to BIS code of safety and wiring installation

- 7. Electric Motors and Pumps: (6 hrs)
 - 1.0 Definition and various application of single and three phase motors
 - 2.0 Conversion of horse power in watts or kilowatts
 - 3.0 Type of pumps and their applications
 - 4.0 Use of direct online starter and star delta starter

PRACTICAL EXERCISES IN ELECTRICAL ENGINEERING:

1. Use of Megger:
Objective: To make the students familiar with different uses of megger
2. Connection of a three phase motor and starter with supply including fuses and reversing of direction of rotation.
Objective: Students may be made familiar with the equipment needed to control a three-phase motor
The students must experience that by changing any two phases, the direction of rotation is reversed.
3. Connection of a lamp, ceiling fan, socket outlet, geyser, desert cooler, voltage stabilizer etc.
Objective: Students may be made familiar with the different types of equipment and circuits used in the domestic installations
4. Trouble shooting in a three-phase motor

Note: The teacher may create anyone of the following faults
 - (a) Loose connections
 - (b) Blown fuse
 - (c) Tripped overload protection
 - (d) Incorrect direction of rotation
 - (e) Single phasing
 - (a) Burnt winding to be simulated by a loose connection or short circuiting behind a terminal box.
Objective: The students must be able to detect the most common faults, which may occur in a three-phase motor, using meggar and a test lamp wherever necessary
- 6 Treatment of electric shock
Note: The teacher may give a demonstration how a victim of electric shock must be treated.

Objective: Students must be trained to treat the persons suffering from an electric shock
6. Demonstration and study of Domestic installation components used in single phase and three phase wiring
7. Demonstration and study of distribution line components
8. Demonstration and study of a distribution Board

Note: Students may be asked to study the distribution board in the institution and note down all accessories.

Objective: Students must be made familiar with the distribution board

9. Connections and taking reading of an analog/digital energy meter(single phase and three phase).

Objective: Students may be asked to connect an energy meter to a load and calibrate the reading with a stop watch and counting the number of revolutions of the energy meter disk in case of an analog meter and reading in case of a digital meter.

10. Demonstration and the study of submersible motor pump set and its working

Objective: To tell use of the set in water supply and irrigation works

PART C

CIVIL ENGINEERING

Theory

1. Construction Materials (10 hrs)
Basics of various construction materials such as stones, bricks, lime, cement and timber along with their properties, physical/ field testing and uses, elements of brick masonry.
1. Foundations (8 hrs)
i) Bearing capacity of soil and its importance
ii) Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines
2. Basic concept of concrete (8 hrs)
Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/ field testing of concrete, mixing of concrete
3. RCC (6 hrs)
Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building

PRACTICAL EXERCISES IN CIVIL ENGINEERING

1. Testing of bricks
a) Shape and size
b) Soundness test
c) Water absorption
d) Crushing strength
2. Testing of concrete
a) Slump test

- b) Compressive Strength of concrete cube
3. 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

INSTRUCTIONAL STRATEGY

While imparting instructions, teachers are expected to lay more emphasis on concepts and principles. It will be better if the classes for general engineering are conducted in the laboratories and organized demonstrations for explaining various concepts and principles.

RECOMMENDED BOOKS

Mechanical Engineering

1. General Mechanical Engineering by M. Adithan; TTTI, Chandigarh
2. Basic Civil and Mechanical Engineering by Jayagopal; Vikas Publications, New Delhi
3. IC Engines and Automobile Engineering by Dr.MP Poonia, Standard Publishers, New Delhi
4. Refrigeration and Air Conditioning by RK Rajput; SK Kataria and sons; Ludhiana
5. Theory of Machines by RS Khurmi and JK Gupta; S. Chand and Company Ltd., New Delhi

Electrical Engineering

1. Electrical Technology Part 1: Basic Electrical Engineering by Theraja, BL; S Chand and Company, New Delhi
2. Principles of Electrical Engineering by Gupta , S Chand and Company, New Delhi
3. Basic Electrical Engineering by Mehta VK; S Chand and Company, New Delhi
4. Basic Electricity and Measurements by Suryanarayan NV and N Delhi; Tata McGraw Hill, 1987, New Delhi
5. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and sons, New Delhi
6. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill, New Delhi
7. Basic Electricity by BR Sharma; Satya Parkashan, New Delhi

Civil Engineering

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

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
PART-A (MECHANICAL ENGINEERING)			
1.	Transmission of Power	8	12
2.	Internal combustion Engines	10	15
3.	Refrigeration and Air conditioning System	8	13
4.	Hydraulics	6	10
PART-B (ELECTRICAL ENGINEERING)			
1.	Basic Quantities of Electricity	4	5
2.	Application and Advantages of Electricity	3	5
3.	Various Types of Power Plant	3	5
4.	Transmission and Distribution System	6	10
5.	Supply from the Poles to the Distribution Board	4	5
6.	Domestic Installation	6	10
7.	Electric Motors and Pumps	6	10

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
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PART-C (CIVIL ENGINEERING)

1.	Constructional Materials	10	15
2.	Foundations	8	12
3.	Basic concept of concrete	8	13
4.	RCC	6	10

Note:

Total time and marks will be sum of any two sections. Total time will be 64 hours and total marks will be 100 in this case.

ELECTRICAL AND ELECTRONIC WORKSHOP PRACTICE

L T P
- - 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.

DETAILED CONTENTS

1. Identification of tool and equipment, Study of electrical safety measures as mentioned in the Electricity Rules and shock treatment including first aid.
2. Wire jointing
 - 1.0 Straight married joint
 - 2.0 Technology-joint
 - 3.0 Western union joint
 - 4.0 Britannia joint
 - 5.0 Twist sleeve joint
 - 6.0 Bolted type joint
3. Filling and crimping of thimbles (using hydraulic and hand crimping tool)
4. Wiring of main distribution board with four outgoing circuits for light and power loads including main switch and fuses (only internal connection)
5. Construction of an extension board with two 5A sockets, one 15A socket controlled by their respective switches, a fuse and indicator
6. Wiring of a switch board containing at least two switches, one fan regulator and one 5/15A socket controlled by their respective switches using piano type switches and matching socket
7. Wiring of a series test lamp board and to use it for finding out simple faults
8. Fault finding and repair of a tube light circuit
9. Wiring and testing of alarm and indicating circuits using relay, push buttons and bells (simple single phase circuits)

10. Assembly of distribution board/ panel using MCB, main switch, changeover switch and ELCB etc.
11. Testing of domestic wiring installation using meggar
12. Power cable jointing using epoxy based jointing-I and Demonstration of laying of underground cables at worksite
13. Soldering and de-soldering practice (soldering and de-soldering of electronic components on PCB) in Electronic lab-I
14. Use of data book to know the parameters of a given transistor
15. Battery charger - Repair and maintenance
16. Power supplies: (5 hrs)
Working Principles of different types of power supplies viz. CVTs, UPS, Stabilizers, SMPS, IC voltage regulator (78 XX,79XX)

ELECTRICAL MACHINES - I

L T P
4 - 3

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

DETAILED CONTENTS

1. Introduction to Electrical Machines (6 hrs)
 - 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 Generalised theory of electrical machines

2. DC Machines (24 hrs)
 - 2.1 Main constructional features, Types of armature winding (compound wave)
 - 2.2 Function of the commutator for motoring and generation action
 - 2.3 Factors determining induced emf equation
 - 2.4 Factors determining the electromagnetic torque(commutation and Armature Reaction)
 - 2.5 Significance of types of machines
 - 2.6 Significance of back e.m.f., the relation between back emf and Terminal voltage
 - 2.7 Performance and characteristics of different types of DC motors
 - 2.8 Speed control of dc shunt/series motors
 - 2.9 Need of starter, three point dc shunt motor starter and 4 point starter
 - 2.10 Applications of DC motors
 - 2.11 Faults in dc machines and their retrospective
 - 2.12 Losses in a DC machine by direct loading method,Electrical and Macheanical
 - 2.13 Determine of loses and efficiency by Swimburn test and Efficiency

3. Transformers (single phase) (24 hrs)
 - 3.1 Introduction
 - 3.2 Constructional features of a transformer and parts of transformer
 - 3.3 Working principle of a transformer
 - 3.4 EMF equation

- 3.5 Transformer on no-load and its phasor diagram
 - 3.6 Transformer on load (including voltage drops and its phasor diagram)
 - 3.7 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
 - 3.8 Mutual and leakage fluxes, leakage reactance
 - 3.9 Equivalent circuit
 - 3.10 Relation between induced emf and terminal voltage, regulation of a transformer-mathematical relation
 - 3.11 Losses in a transformer
 - 3.12 Open circuit and short circuit test. Back to Back test, Calculation for efficiency, condition for maximum efficiency
 - 3.13 Cooling of transformer, conservator
 - 3.14 Auto transformer construction, working and applications
 - 3.15 Different types of transformers, Instrument Transformer, Dry type transformers, Furnace transformer, earthing Transformer Traction Transformer and its use, Welding Transformer, Construction and comparison between power and Welding transformer.
4. Three phase Transformers (10 hrs)
- 4.1 Construction of three phase transformer
 - 4.2 Types of three phase transformer i.e. delta-delta, delta-star, star-delta and star-star, Scott connection, V-V connection , Zig-Zag connection
 - 4.3 Conditions for parallel operation (only conditions are to be studied)
 - 4.4 On load tap changer, ON/OFF load tap changer
 - 4.5 Difference between power and distribution transformer
 - 4.6 Cooling of power transformers as per BIS code.

LIST OF PRACTICALS

1. Introduction to electrical machines

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

OR

Measurement of the angular displacement of the rotor of a slip-ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding
2. DC machines
 - 2.1 Speed control of dc shunt motor (i) Armature control method (ii) Field control method
 - 2.2 Study of dc series motor with starter (to operate the motor on no load for a moment)
 - 2.3 Determination of efficiency of DC motor by swimbuns test at (i) rated capacity (ii) half full load
 - 2.4 Determination of efficiency of a DC machine by direct loading method.

3. Transformers (single phase)
 - 3.1 To perform open circuit and short circuit test for determining equivalent circuit of a transformer
 - 3.2 To determine the regulation and efficiency from the data obtained from open circuit and short circuit test at full load
4. Three-phase transformers
 - 4.1 Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations
 - 4.2 Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations.

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Machines by SB Gupta, SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction to Electrical Machines	06	15
2.	DC Machines	24	20
3.	Transformers(single phase)	24	20
4.	Three phase Transformers	10	10
Total		64	100

ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS(EIM)

L T P
4 - 3

RATIONALE

Diploma holders in Electrical Engineering has 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 of measuring instruments. Persons working on control panels in power plants, substations and in process and other type of industries, will come across use of various types of instruments and has to take measurements.

Instruments used to read and observe the electrical quantities like current, voltage, power, energy, frequency, resistance etc and their wave shapes have been incorporated in this subject. The diploma holders will know the construction and use of various types of instruments after studying this subject.

DETAILED CONTENTS

1. Introduction to Electrical Measuring Instruments: (8 hrs)
 - 1.1 Concept of measurement and instruments
 - 1.2 Electrical quantities and instruments for their measurements
 - 1.3 Types of electrical measuring instruments – indicating, integrating and recording instrument
 - 1.4 Essentials of indicating instruments – deflecting, controlling and damping torque

2. Ammeters and Voltmeters (Moving coil and moving iron type): (6 hrs)
 - 2.1 Concept of ammeters and voltmeters and difference between them
 - 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. Wattmeters (Dynamometer Type) (5 hrs)

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

5. Energy meters (6 hrs)

Construction, working principle, merits and demerits of single-phase and three-phase induction type energy meters

 - 4.1 Errors and compensation
 - 4.2 Simple problems
 - 4.3 Construction and working principle of maximum demand indicators
 - 4.4 Construction and working principle of digital energy meters.

6. Miscellaneous Measuring Instruments: (10 hrs)
- Construction, working principle and application of Meggar, Earth tester, analog Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter)
- Instrument Transformers: Construction, working and applications
- a) CT and their ratio and phase angle error.
 - b) PT and their ratio and phase angle error
6. Electronics Instruments: (6 hrs)
- 6.1 Cathode Ray Oscilloscope: Block diagram, working of CRO and its various controls. Applications of CRO.
 - 6.2 Digital multi-meter (only block diagram)
7. Measurement of Inductance, capacitance and Resistances, through ac Bridges (8 hrs)
8. Power Measurements in 3-phase circuits: (5 hrs)
- 8.1 Three wattmeter method
 - 8.2 Two watt meter method
9. Measurement of Non-electrical Quantities (10 hrs)
- Basic concept of Pressure measurement, flow measurement, level measurement, displacement measurement

LIST OF PRACTICALS

1. Study the constructional details, working and calibration of an ammeter (moving coil and moving iron type)
2. Use of multimeter for measuring voltage, current and resistance.
3. Study the constructional details and working of 1-phase energy meter.
4. To calibrate 1-phase energy meter by direct loading method.
5. Study the constructional details, working of a meggar and measurement of insulation resistance
6. To measure the value of earth resistance with the help of earth tester.
7. To measure power, power factor in a 1-phase circuit, using wattmeter and power factor meter and verify results with calculations.
8. Measurement of power and p.f. of a three-phase load by two wattmeter method
9. Measurement of voltage and frequency of a sinusoidal signal with CRO.
10. Measurement of power in a 3 phase circuit using CT, PT and 3-phase energy meter.

11. Connecting appropriate instruments at the supply of an installation to measure supply voltage, frequency, power, maximum demand, Phase sequence, energy consumed (Instruments to be used are CRO, VTVM, Maximum demand Indicator, phase sequence indicator, Energy meter and power factor meter)
12. Use of LCR meter for measuring inductance, capacitance and resistance.

RECOMMENDED BOOKS

1. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
2. Electrical Measurements and Measuring Instruments by E W Golding and Widdis; Wheeler Publishing House, New Delhi
3. Electrical Measurements and Measuring Instruments by SK Sahdev, Unique International Publications, Jalandhar
4. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
5. Electric Instruments by D. Cooper
6. Electronics Instrumentation by Umesh Sinha
7. Basic Electrical Measurements by Melville B. Staut.
8. Electrical Measurement by J.B Gupta
9. Electrical technology Part-1 by B.L.Thareja

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction to Electrical Measuring Instruments	08	15
2.	Ammeters and Voltmeters	06	10
3.	Wattmeters	05	7
4.	Energy meter	06	10
5.	Miscellaneous Measuring instruments	10	15
6.	Electronic Instruments	06	10
7.	Measurement of Inductance, Capacitance and Resistance	08	10
8.	Power Measurement in 3-phase circuits	05	8
9.	Measurement of Non-electrical Quantities	10	15
Total		64	100

ELECTRONICS-II

L T P
4 - 3

RATIONALE

The purpose of the introduction of electronics in the electrical engineering diploma course has been already explained in the rationale of the subject Basic Electronics. In this course topic like Amplifiers, Oscillators and Wave Shape Circuits have been dealt with.

DETAILED CONTENTS

1. Transistor Audio Power Amplifier (10 hrs)
 - 1.1 Difference between voltage and power amplifier
 - 1.2 Important terms in Power Amplifier collector efficiency, distortion and dissipation capability
 - 1.3 Classification of power amplifier class A, B and C
 - 1.4 Class A single-ended power amplifier, its working and collector efficiency
 - 1.5 Impedance matching in a power amplifier using transformer
 - 1.6 Heat sinks in power amplifiers
 - 1.7 Push-pull amplifier circuit details, working and advantages (no mathematical derivations)
 - 1.8 Principles of the working of complementary symmetry push-pull amplifier
2. Tuned Voltage Amplifier (7 hrs)
 - 2.1 Introduction
 - 2.2 Series and parallel resonance
 - 2.3 Single and double tuned voltage amplifiers
 - 2.4 Frequency response of tuned voltage amplifiers
 - 2.5 Applications of tuned voltage amplifiers
3. Feedback in Amplifiers (7 hrs)
 - 3.1 Feedback and its importance, positive and negative feedback and their need
 - 3.2 Voltage gain of an amplifier with negative feedback $A = \frac{A}{1 + A\beta}$

1+AB

- 3.3 Effect of negative feedback on voltage gain, stability, distortion, band width, output and input impedance of an amplifier (No mathematical derivation)
- 3.4 Typical feedback circuits
- 3.5 Effect of removing the emitter by-pass capacitor on an ordinary CE transistor amplifier
- 3.6 Emitter follower and its applications
- 4. Sinusoidal Oscillators
 - 4.1. Sinusoidal Oscillators – positive feedback in amplifiers
 - 4.2. Difference between an oscillator and an alternator
 - 4.3. Essentials of an oscillator
 - 4.4. Circuit details and working of LC oscillators viz. Tuned Collector, Hartley and Colpitt's oscillators
 - 4.5. R-C oscillator circuits, phase shift and Wein bridge oscillator circuits
 - 4.6. Introduction to piezoelectric crystal and crystal oscillator circuit
- 5. Wave-Shaping and Switching Circuits (15 hrs)
 - 5.1 Concept of Wave-shaping
 - 5.2 Wave-shaping circuits
 - 6.4.1 R-C differentiating and integrating circuits
 - 6.4.2 Diode clipping circuits
 - 6.4.3 Diode clamping circuits
 - 6.4.4 Application of wave-shaping circuits
 - 6.5 Transistor as a switch (explanation using CE transistor characteristics)
 - 6.6 Collector coupled astable, monostable, bistable multivibrator circuits (explanation using wave shapes). Brief mention of uses of multivibrators
 - 6.7 Working and applications of transistor inverter circuit using power transistors
- 7. Working Principles of different types of power suppliers viz. CVTs, UPS, Stabilizers, SMPS, IC voltage regulator etc. (5 hrs)
- 8. Operational Amplifier

- 7.1. The basic operational amplifier. The differential amplifier. The emitter coupled differential amplifier. Offset even voltages and currents
- 7.2. Basic operational amplifier applications, analog integrator and differentiator
- 7.3. Familiarisation with specifications and pin configuration of IC 741
- 7.4. Block diagram and operation of 555 IC timer

LIST OF PRACTICALS

1. To measure (a) optimum load (b) output power in Class A single-ended transistor amplifier
2. To measure (a) optimum load (b) output power (c) signal handling capacity in a push-pull amplifier
3. To measure voltage gain and plot the frequency response curve of single-stage feedback
4. To measure (a) voltage gain (b) input and output impedance for an emitter follower circuit
5. To measure frequency generation in (a) Hartley (b) Colpitt and (c) Wein bridge oscillators (d) phasing oscillator
6. To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant
7. (i) Clipping of one portion of sine-wave using diode
8. Clipping of both portion of sine-wave using:
 - a) diode and dc source
 - b) zener diodes
 (ii) Clamping a sine-wave to:
 - a) Negative dc voltage
 - b) Positive dc voltage
9. To generate square-wave using an astable multivibrator and to observe the wave form on a CRO
10. To observe Triggering and working of a bistable multivibrator circuit and observe its output wave form on a CRO
11. To use the op-Amp (IC 741) as inverting one) and non-inverting amplifiers, adder, comparator, integrator and differentiator
12. To study the pin configuration and working of IC 555 and its use as nonstable and astable multivibrator

13. To realize the regulated power supply by using three terminal voltage regulator ICs such as 7805, 7905, 7915 etc.

RECOMMENDED BOOKS

1. A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi
2. Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi
3. Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi
4. Operational Amplifiers and Linear Circuits by Rama Kant and A. Gaykwad, Prentice Hall of India, New Delhi
5. Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
6. Electronic Devices and Circuits by Millman & Halkias, McGraw Hill, New Delhi
7. Analog Electronics – II by DR Arora, Ishan Publication, Ambala
8. Electronic Devices and Circuits by JC Karhara, King India Publication, New Delhi
9. Electronic Devices and Circuits-I, Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Transistor Audio Power Amplifier	10	15
2.	Tuned Voltage Amplifier	07	20
3.	Feedback in Amplifiers	07	20
4.	Sinusoidal oscillators		10
5.	Wave-Shaping and Switching Circuits	15	15
6.	Working principles of different power suppliers	05	20
7.	Operational Amplifier		
Total		64	100

ELECTRICAL ENGINEERING DESIGN AND DRAWING - II

L T P
- - 6

RATIONALE

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

- i) Read, understand and interpret engineering drawings
- ii) Communicate and correlate through sketches and drawings
- iii) Prepare working drawings of alternator panels, transmission and distribution lines and sub-stations.

The contents of this subject has been designed to develop requisite knowledge and skill of electrical drawing in the students of diploma in electrical engineering.

DETAILED CONTENTS FOR EXERCISES

- | | | |
|----|--|----------|
| 1 | Contractor Control Circuits | (56 hrs) |
| | Design of Circuit Drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors | |
| | 1.1 DOL starting of 3-phase induction motor | |
| | 1.2 Remote Control of 3-phase induction motor | |
| | 1.3 3-phase induction motor getting supply from selected feeder | |
| | 1.4 Two speed control of 3-phase induction motor | |
| | 1.5 Limit switch control of a 3-phase induction motor | |
| | 1.6 Sequential Operation of two motors using time delay relay | |
| | 1.7 Automatic star delta starter for 3-phase Induction Motor | |
| 2. | Earthing | (20 hrs) |
| | 2.1 Purpose of earthing | |
| | 2.2 Different types of earthing, drawings of plate and pipe earthing | |
| | 2.3 Procedure of earthing, list of materials required and costing | |

- 2.4 Method of reducing earth resistance
- 2.5 Relevant IS specifications of earth electrode for earthing a transformer, a high building, a transmission tower.
- 2.6 Earthing layout of distribution transformer
- 2.7 Substation earthing layout and earthing materials
- 2.8 Block/ circuit diagram of 11kV, 33kV, 66kV, 132 kV sub-stations layout.
- 3. Drawings of Machine Parts(Assembly) (20 hrs)
 - 3.1 End cover of induction motor
 - 3.2 Rotor of a squirrel cage induction motor
 - 3.3 Field coil of a DC motor
 - 3.4 Terminal plate of an induction motor
 - 3.5 Motor body (induction motor) as per IS specifications
 - 3.6 Sliprings of 3-phase induction motor

RECOMMENDED BOOKS

- 1) Electrical Design and Drawings by Raina & Bhattacharya
- 2) Electrical Design & Drawings by Sarabjeet Singh
- 3) IEEE Guide 80 for Earthing, IEEE Publication, New York
- 4) Electrical Controls in Industry by Charles Siskind
- 5) BIS for Electrical Earthing

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Contractor Control Circuits	56	50
2.	Earthing	20	25
3.	Drawings of Machine Parts (Assembly)	20	25
Total		96	100

ELECTRICAL WORKSHOP PRACTICE

L T P
- - 6

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, fault finding, wiring in electrical appliances and installations.

DETAILED CONTENTS

1. To carry out pipe/plate earthing for a small house and 3-phase induction motor. Testing the earthing using earth tester.
 2. Connections of single phase and 3-phase motors, through an appropriate starter and to change their direction of rotation
 3. Wiring, testing and fault finding of the following contactor control circuits operating on 3-phase supply:
 - a. Remote control circuits
 - b. Time delay circuits
 - c. Inter locking circuits
 - d. Sequential operation control circuits
 4. Re-winding of a fan (ceiling and table) and choke of fluorescent tube light
 5. Dismantling/assembly of star-delta/DOL starter and slipping induction motor starter
 6. Dismantling and assembly of voltage stabilizers
 7. Repair and maintenance of domestic electric appliances, i.e. electric iron, geyser, fan, heat convector, Semi-automatic washing machine, desert cooler, room heater, electric kettle, electric oven, electric furnace etc
- Note: At least five electrical appliances as mentioned above be given to a group of 2 students for their repair and maintenance.
8. Repair and Maintenance of Single phase and 3 phase small motor (AC or DC)
 9. Assembly and repair of small Transformer and Electronic ballast on P.C.B
 10. Identification of necessary tools and equipment for repair and maintenance of electric gadgets e.g. hand drill machine, bearing puller, cutter, sniper, insulation tester etc.

INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

L T P
4 - -

RATIONALE

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.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Tools and Accessories: | (04 hrs) |
| | 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, workmen's safety devices | |
| 2. | Installation | (18 hrs) |
| | 2.1 Installation of transmission and Distribution Lines: | (10 hrs) |
| | Erection of steel structures, connecting of jumpers, tee-off points, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway 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, Testing and Commissioning. | |
| | Laying of service lines, earthing, provision of service fuses, installation of energy meters | |
| | 2.2 Laying of Underground Cables: | (08 hrs) |
| | 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 marking as installation 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, introduction to cable filling compounds, epoxy resins and hardeners, cable jointing and terminations, testing and commissioning.

- 2.3 Elementary idea regarding, inspection and handling of transformers; Pole mounted substations, plinth mounted substations, grid substation, bus-bars, isolation, 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.
- 2.4 Testing of various electrical equipment such as electrical motor, transformers, cables and generator and 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. Maintenance (42 hrs)
- 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 and temporary earths, cancellation of permit and restoration of supply.
- Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections;
- Location of faults using Meggar, effect of open or loose neutral connections, provision of proper fuses on service lines and their effect on system, causes of dim and flickering lights.
- 3.3 Maintenance of Distribution Transformers
- Transformer maintenance and points to be attended to in respect of various items of equipment
- Checking of insulation resistance, transformer oil level and BDV test of oil, measurement of earth resistance of a transformer.
Transformer oil testing as per BIS specifications. Maintenance of breathers and oil level indicators.

3.4 Maintenance of Grid Substations

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

3.5 Maintenance of Motors

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

3.6 Domestic Installation

Introduction, testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation resistance between conductors continuity or open circuit test, short circuit test, testing of earthing continuity location of faults, IE rules for domestic installation

Important Note:

The teachers must organise study/ field visit(s) . Students have to submit a complete report of the visit regarding above mentioned topics. There will be sessional and viva voce marks for above activities.

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

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Toolsand Accessories	04	10
2.	Installation	18	30
3.	Maintenance	42	60
Total		64	100

ENTREPRENEURIAL AWARENESS CAMP

The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurial development, scope of setting up small scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. In addition, the students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development and related topics.

The camp is to be organized preferably at a stretch for two to three days during 4th semester(second year). Expert Lectures will be delivered on the following broad topics. There will be no examination for this subject/camp.

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Consideration Contractor Control Circuits s for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

ELECTRICAL MACHINES-II

L T P
5 - 3

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. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

DETAILED CONTENTS

1. Synchronous Machines (30 hrs)
 - 1.1 Construction and working principle of synchronous Machines
 - 5.5 Production of rotating magnetic field in a three phase winding
 - 5.6 Main constructional features of Rotor excitation systems, static excitation system
Generation of three phase emf in stator
 - 1.4 Concept of distribution factor and coil span factor and emf equation of Alternator
Armature reaction on unity, lag and lead power factor
 - 5.5 Voltage regulation by synch-impedance method
 - 5.6 Need and necessary conditions of parallel operation of alternators
 - 1.7 Synchronizing an alternator (Synchroscope and three lamp method) with the bus bars
 - 1.8 Operation of single synchronous machine independently supplying a load
 - 5.5 Operation of synchronous machine as a motor –its starting methods
 - 1.10 Effect of change in excitation of a synchronous motor
 - 1.11 Cause of hunting and prevention
 - 1.12 Rating and cooling of synchronous machines(upto 500 M Watts)
 - 1.13 Applications of synchronous machines (as an alternator, as a synchronous condenser)

2. Induction Motors (20 hrs)
 - 2.5 Salient constructional features and working principle of squirrel cage and slip-ring 3-phase induction motors
 - 2.6 Rotor resistance, inductance, emf and current and its frequency, locking of stator and Rotor fields
 - 2.7 Relationship between copper loss and the motor slip
 - 2.8 Power flow diagram of an induction motor
 - 2.9 Factors determining the torque
 - 2.10 Torque-slip curve, stable and unstable zones
 - 2.11 Effect of rotor resistance upon the torque slip relationship

- 2.12 Double cage rotor motor and its applications
 - 2.13 Starting of 3-phase induction motors, DOL, star-delta, auto transformer
 - 2.14 Causes of low power factor of induction motors
 - 2.15 Testing of 3-phase motor on no load and blocked rotor test and to find different losses and efficiency
 - 2.16 Speed control of induction motor, conventional and thyristorized
3. Fractional Kilo Watt (FKW) Motors (20 hrs)
- 3.1 Single phase induction motors; Construction characteristics and applications
 - 3.2 Nature of field produced in single phase induction motor
 - 3.3 Split phase induction motor
 - 3.3.1 Capacitors start and run motor
 - 3.3.2 Shaded pole motor
 - 5.5.1 Reluctance start motor
 - 3.4 Alternating current series motor and universal motors
 - 3.5 Single phase synchronous motor
 - 3.5.1 Reluctance motor
 - 3.5.2 Hysteresis motor
4. Special Purpose Machines (8 hrs)
- Construction and working principle of linear induction motor, stepper motor, schrage motor, submersible motor, totally and flame proof motor, vertical motors
5. Power converter (02 hrs)

LIST OF PRACTICALS

- 2 Synchronous machines:
- 5.2 Demonstration of revolving field set up by a 3-phase wound stator
 - 5.3 Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant
 - 1.3 Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
 - 1.4 Parallel operation of polyphase alternators and their load sharing
 - 1.5 Determination of the effect of variation of excitation on performance of a synchronous motor and to plot V- curve
2. Induction Machines:
- 2.11 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)
 - 2.12 Determination of effect of rotor resistance on torque speed curve of a 3 phase induction motor
3. Fractional Kilowatt Motors:

- 3.11 To study the effect of a capacitor on the starting and running of a single-phase induction motor.
- 3.12 Reversing the direction of rotation of a single phase capacitor induction motor
- 3.13 Study of construction and operation of a ac series motor, reluctance motor and hysteresis motor, submersible pump motor and a flame proof motor

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Engineering by JB Gupta, SK Kataria & sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Synchronous Machines	30	35
2.	Induction Motors	20	30
3.	Fractional Kil watt (FKW) Motors	16	20
4.	Special Purpose Machines	08	10
5.	Power converter	06	5
Total		80	100

ELECTRICAL POWER – 1

(Generation, Transmission and Distribution of Electrical Power)

L T P
5 - -

RATIONALE

The majority of the polytechnic passouts have to perform various activities in the State Electricity Boards 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 to 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 Generation, Transmission and Distribution of Electrical Power.

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Power Generation | (20 hrs) |
| | 3.1 Main resources of energy, conventional and non-conventional | |
| | 3.2 Different types of power stations, thermal, hydro, gas, diesel and nuclear power stations. Flow diagrams and brief details of their operation, comparison of the generating stations on the basis of running cost, site, starting, maintenance etc. | |
| | 3.3 Importance of non-conventional sources of energy in the present scenario. Brief details of solar energy, bio-energy, wind energy co. generation/C.P.P | |
| 2. | Transmission Systems | (25 hrs) |
| | 2.1 Layout of transmission system, selection of voltage for H.T and L.T lines, Over head line and under ground cable laying advantages of high voltage for transmission system voltages prevalent in India, concept of national and regional grid. Role of Central Electricity Authority. | |
| | 2.2 Comparison of different system: AC versus DC for power transmission, conductor material and sizes from table | |
| | 2.3 Constructional features of Overhead transmission lines: Types of supports, types of insulators, Selection of insulators, conductors, earth wire and their accessories, Transposition and string efficiency of lines. Limitation of power transmission through U.G cable | |
| | 5.5 Mechanical features of line: Importance of sag, calculation of sag, effects of wind and ice and related problems; Indian electricity rules pertaining to clearance | |
| | 5.6 Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission lines (medium and long), voltage regulation, concept of corona. Effects of corona and remedial measures | |

- 5.7 DC transmission, its advantages and disadvantages w.r.t a.c transmission, different configurations and prevalent system voltages in India . Layout and Block diagram
3. Distribution System (15 hrs)
- 5.5 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 /U.G cable
- 3.2 Construction of LT and HT power cables advantages/disadvantages
- 3.3 Preparation of estimates for LT and HT overhead distribution lines/ U.G Cable
- 3.4 Calculation of line losses in distribution system
4. Power Factor: (5 hrs)
- 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
- 5 Various Types of Tariffs: (5 hrs)
- 5.1 Tariffs
- 5.2 Block rate, flat rate, maximum demand and two part tariffs
- 5.3 Simple problems
6. Economic Consideration: (10 hrs)
- Fixed running cost, load curves, demand factor, load factor, diverting factor, power factor and their effect on cost of generation Base load, peak load, Inter connection of power station, Horizontal grid

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, Unique International Publications, Jalandhar
4. Electrical Power System by VK Mehta, S Chand & CO., New Delhi
5. Electrical Power System by JB Gupta, Kataria and Sons, New Delhi

6. Sub-Station Design by PS Satnam, Dhanpat Rai and Co., New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Power Generation	20	25
2.	Transmission systems	25	25
3.	Distribution system	15	20
4.	Power Factor	05	05
5.	Various Types of Tariffs	05	05
6.	Economic Consideration	10	10
Total		80	100

INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

L T P
4 - 2

RATIONALE

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 method. The old magnetic and electrical control schemes have all become obsolete. Electrical 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 electronics is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance to the subject this has been incorporated in the curriculum.

DETAILED CONTENTS

1. Introduction to SCR (8 hrs)
 - 1.5. Construction and working principles of an SCR, two transistor analogy circuit and characteristics of SCR
 - 1.6. SCR specifications and rating
 - 1.7. Construction, working principles and V-I characteristics of DIAC and TRIAC
 - 1.8. Basic idea about the selection of heat sinks for SCR and TRIACS
 - 1.9. Methods of triggering a Thyristor. Study of triggering circuits
 - 1.10. UJT, its Construction, working principles and VI characteristics, UJT laxation oscillator
 - 1.11. Commutation of Thyristors
 - 1.12. Series and parallel operation of Thyristor
 - 1.13. Applications of SCR and TRIACS such as light intensity control control of DC and universal motor, fan regulator, battery charger etc.

2. Controlled Rectifiers (5 hrs)
 - 3.14 Single phase half wave controlled rectifier with resistive load and inductive load
 - 3.15 Single phase half controlled full wave rectifier
 - 3.16 Fully controlled full wave rectifier bridge
 - 3.17 Single phase full wave centre lap rectifier
 - 3.18 Three phase full wave half controlled bridge rectifier
 - 3.19 Three phase full wave fully controlled bridge rectifier

3. Inverters, choppers, dual converters and cyclo convertors (12 hrs)
 - 3.1 Inverter-introduction, working principles, voltage and current driven in series and paralled invertors and applications

- 3.2 Choppers introduction, types of choppers and their working principles and applications
- 3.3 Dual Convertors-introduction, types of cyclo-convertors, working principles and applications
4. Thyristor Control of Electric Drives (14 hrs)
- 1.1 DC drives control
- 1.2 Half wave Control of drives
- 1.3 Full wave Control of drives
- 1.4 Chopper drive Controller
- 1.5 AC drive Controller
- 1.6 Phase control
- 1.7 Variable frequency a.c. drives
- 1.8 Constant V/F appreciation
- 1.9 Voltage controlled inverter drives
- 1.10 Constant current inverter drives
- 1.11 Cyclo convertors controlled AC drives
- 1.12 Slip control AC drives
5. Uninterrupted power supplies (5 hrs)
- 2.1 UPS, online, stand by, Redundant UPS, DC UPS
- 2.2 Storage devices, battery charger with UPS
6. Static Control of Machines (10 hrs)
- Advantages and disadvantages of static control compared to magnetic control. Development of simple control circuits using logic gates, off-return and retentive memory elements. Input and output devices for solid state logic circuits. Study of some industrial control circuits like product dispersion, product inspection conveyor system etc. using shift registers, counters, decoder, mono shot, clock, down counter and encoder.
7. Programmable Logic Controllers (10 hrs)
- Parts of a programmable controller, inputs/output section, central processing unit, input image table, output image table, user program memory, variable data memory, complete scan cycle, the programming terminals, programming basics, relay, timer, Counter and Sequencer type instructions, analog operation.

LIST OF PRACTICALS

3. To draw firing characteristics of an SCR
4. To draw firing characteristics of a TRIAC
5. To draw firing characteristics of a DIAC
6. To draw unijunction transistor characteristics
7. Observe the output wave of an UJT relaxation oscillator

8. Observe the wave shape across SCR and load of an illumination control circuit
9. Fan speed regulator using TRIAC (fabrication of this circuit)
10. Speed-control of a DC shunt motor or universal motor
11. Single phase half wave controlled and full wavecontrolled rectifier
12. Single phase controlled rectifier
13. Three phase controlled rectifier
14. Single phase inverter circuit (fabrication of this circuit)
15. Learning programme entry and editing of PLC using Hand held programmer.
16. Learning programme entry and editing on PLC through personal computer which is interfaced to PLC through a software package.
17. Writing, testing and debugging of simple programmes to control the working of different components like motors, solenoid operated cylinder pistons, relays, flashers etc. using sensors on a PLC trainer.
18. Wiring of different types of starters for three phase wound and squirrel cage induction motor.
19. Study of some actual control drawings from industry.
20. Design and modification of control of a given circuit as per designed control requirements.

BOOKS RECOMMENDED

5. Control of Electrical Machines by S.K. Bhattacharya and Brijinder Singh. Tata Mc Graw Hill, New Delhi
6. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions.
7. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
8. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
9. Power Electronics by PC Sen
10. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
11. Industrial Electronics & Control by SK Bhattacharya & S Chatterji, New Age international Publications(P) Ltd, New Delhi
12. Power Electronics by SK Sahdev, Unique International Publication, Jalandhar
13. Power Electronics by JC Karhava, King India Publication,

14. Fundamentals of Electrical Devices by Gopal K Dubey, Narosa Publishing House Pvt. Ltd, New Delhi
15. Power Electronics and Controls by Samir K Datta, Prentice Hall of India, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction to SCR	08	10
2.	Controlled Rectifiers	05	10
3.	Inverters, Choppers, Dual Converters and Cyclo Converters	12	20
4.	Thyristor Control of Electric Drives	14	25
5.	Uninterrupted Power Supplies	05	5
6.	Static Control of Machines	10	15
7.	Programmable Logic Controllers	10	15
Total		64	100

Elective - I

INSTRUMENTATION

L T P
4 - -

RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. Electrical supervisor employed in maintenance of electrical equipment, machinery is required to diagnose faults, rectify them and test the total system for good performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation.

DETAILED CONTENTS

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|----|--|----------|
| 5. | Measurements: | (4 hrs) |
| | Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, signal conditioning and display devices | |
| 6. | Transducers: | (8 hrs) |
| | Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type) | |
| 4. | Measurement of Displacement and Strain: | (10 hrs) |
| | Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges, different strain gauges such as inductance type, resistive type, wire and foil etc. Gauge factor, gauge materials, and their selections, sources of errors and its compensations. Use of electrical strain gauges, strain gauge bridges and amplifiers. | |
| 5. | Force and Torque Measurement: | (10 hrs) |
| | Different types of force measuring devices and their principles, load measurements by using elastic Transducers and electrical strain gauges. Load cells, proving rings. Measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices. | |
| 6. | Pressure Measurement: | (8 hrs) |
| | Bourdon pressure gauges, electrical pressure pick ups and their principle, construction application and use of pressure cells. | |
| 7. | Flow Measurement: | (6 hrs) |
| | Basic principles of magnetic and ultrasonic flow meters | |
| 8. | Measurement of Temperature: | (10 hrs) |

Bimetallic thermometer, pressure thermometers, thermoelectric thermometers, resistance thermometer, thermocouple, thermistors and pyrometer, errors in temperature measurements in rapidly moving fluids. Temperature recorders

7. Measurement of other non electrical quantities (8 hrs)

Measurement of other non electrical quantities such as humidity, pH level, noise, light intensity, vibration etc.

RECOMMENDED BOOKS

5. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
6. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi
7. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Measurements	04	5
2.	Transducers	08	15
3.	Measurement of Displacement and Strain:	10	15
4.	Force and Torque Measurement	10	15
5.	Pressure Measurement	08	10
6.	Flow Measurement	06	10
7.	Measurement of Temperature	10	15
	Measurement of non electrical quantities	08	15
Total		64	100

Elective-II

NON CONVENTIONAL ENERGY SOURCES

L T P
4 - -

RATIONALE

Energy is a crucial input in the process of economic, social and industrial development. High energy consumption has traditionally been associated with higher quality of life, which in turn is related to Gross National Product (GNP). Since the conventional energy resources are under depletion, it is high time to tap the non conventional energy sources. The electrical diploma holder will have to face these challenges in future life. Therefore this subject is offered in diploma programme for future benefit.

DETAILED CONTENTS

5. Introduction: (6 hrs)
Importance of Non conventional sources of energy, Present Scenario, Future Prospects, Economic Criteria
6. Solar Energy: (10 hrs)
Physical Principle of the conversion of Solar radiation into heat, Photo-voltaic cell, Electricity generation, Solar water heaters, Solar Furnaces, Solar cookers, Solar Stills solar pumping.
7. Hydro Energy: (8 hrs)
Hydro-electric Power Plants, Mini and Micro hydro-electric power generation. Magneto Hydro Dynamic (MHD) Power Generation.
8. Bio-energy: (8 hrs)
Bio-mass Conversion Technologies- wet and dry processes. Methods for obtaining energy from Biomass. Power Generation by using gassifiers
9. Wind Energy: (6 hrs)
Wind Energy Conversion, Wind mills, Electricity generation from wind- Types of wind mills, local control, energy storage
10. Geo-thermal and Tidal Energy: (10 hrs)
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.
11. Chemical Energy Sources: (10 hrs)
Design and operating principles of a fuel cell, conversion efficiency, work output and emf of fuel cells, applications storage battery characteristics, types, applications, maintenance of batteries.
12. Thermo Electric Power: (6 hrs)

Basic principle, performance analysis of thermo electric power generation, thermoelectric materials and their application.

RECOMMENDED BOOKS :

5. Solar Energy – Principles of thermal collection and Storage SP Sukhatme, Tata McGraw Hill Publication, New Delhi.
6. Solar Energy Utilization; GD Rai ; Khanna Publishers, New Delhi.
7. Reviews of Renewable Energy Sources, Vol. 3, Edited by MS. Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.
8. Renewable Energy Sources and Conversion Technology by NK Bansal, Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co. Ltd New Delhi.
9. Energy Today and Tomorrow; Maheshwar Dayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
10. Energy Technology (non-conventional, renewable and conventional) by S Rao and BB Parulekar, Khanna Publishers, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction	6	5
2.	Solar Energy:	10	15
3.	Hydro Energy	8	15
4.	Bio Energy	8	15
5.	Wind Energy	6	10
6.	Geo-thermal and Tidal Energy	10	15
7.	Chemical Energy Sources	10	15
8.	Thermo electric power	6	10
Total		64	100

Elective - I

PC MAINTENANCE AND REPAIR

L T P
4 - -

RATIONALE

The PC is the tool that defines today current age and culture. A right understanding about any tool is required to use it effectively. There has been a complete revolution in this area because of rapid advancement in the field of electronics. The PC is the most logical and modern machine and is no more difficult to understand its function. It is very important to learn the various components of PC and how these parts work together. All technically trained individuals must understand the general nature of PC operation of memory, I/O techniques, interfacing applications etc. Looking at the importance and usefulness, this subject has been included in the curriculum.

DETAILED CONTENTS

5. Repair, Servicing and Maintenance Concepts (4 hrs)
Introduction to servicing and maintenance concepts. Meantime between failure (NTBF), Repair maintenance policy, potential problems preventive maintenance and corrective maintenance. Circuit tracing techniques, Concept of shielding grounding and power supply requirements and considerations of computers and its peripherals.

6. Fundamental Trouble Shooting Procedures (8 hrs)
 - Fault location
 - Fault finding aids
 - Service Manuals
 - Test and measuring instruments
 - Special tools
 - Different trouble shooting techniques and methods, logical fault Finding approach
 - Functional area approach
 - Split half method

3. Introduction to PC (06 hrs)
 - e) Origin of PC
 - f) Hardware and software
 - g) Operating system
 - h) Programming language

4. Hardware Components (20hrs)
 - e) Motherboard
 - f) Microprocessors and Co-processors
 - g) Memory – ROM, RAM
 - h) Chipsets and support circuits, its function, system control, peripheral control and memory control
 - i) Bus-architecture, function and various buses i.e. ISA, EISA, VESA, PCI
 - j) Mass storage device i.e. hard disk, floppy disk, compact disk

- k) Input/output devices i.e. keyboard, mouse, display system. Video adopter, audio printers, modems, serial and parallel ports, IEEE 1284, RS-232-C
 - l) General information about computer virus and anti-virus
5. Interfacing Components and Techniques (06 hrs)
- e) Interface systems and standards
 - f) Programmable peripherals interface (PPI) Chip-8255, 8155
 - g) Pin diagrams and programming
6. Troubleshooting of Computer Networks (12 hrs)
- e) Networking Topologies Standards,
 - f) Cabling and Configuration, IEEE Standards for LANS
 - g) LAN failure, cabling connectivity, hub, bridge, switches
 - h) Managing network services TCP/IP
 - i) Address management, DNS, Domain, Work Group
7. Concept of Internet (08 hrs)
- e) Internet Protocols H.T.T.P.
 - f) Simple Networking Management Protocol (SNMP)
 - g) Domain Name Systems (DNS)
 - h) Security
 - i) Electronic Mail
 - j) World Wide Web
 - k) Concept of ATM Networks

RECOMMENDED BOOKS

- 5. Hardware Bible ; Winn. L. Rosch, Techmedia
- 6. The complete PC upgrade and maintenance guide, Mark Minasi, BPB Publications
- 7. Computer Networks, A. Tanenbaum, PHI Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Repair, Servicing and Maintenance Concepts	4	10
2.	Fundamental Trouble Shooting Procedures	8	10
3.	Introduction to PC	6	10
4.	Hardware Components	20	30
5.	Interfacing Components and Techniques	6	10
6.	Troubleshooting of Computer Networks	12	20
7.	Concept of Internet	8	10
Total		64	100

DIGITAL ELECTRONICS AND MICROPROCESSORS

L T P
4 - 2

RATIONALE

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 the light and the new world belongs to it. So it is necessary to give the knowledge of digital electronics to the students. Microprocessor is one of the most exciting technological among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability and flexibility both at the design and the Implementation stages. The decreasing cost of microprocessors with increasing facilities act as catalysts in widening their scope of applications.

DETAILED CONTENTS (Part-A)

- | | | |
|----|---|---------|
| 1. | Number Systems | (4 hrs) |
| | 1.2 Decimal, binary, octal and hexa-decimal number systems and their inter-conversion | |
| | 1.3 Binary addition, subtraction and multiplication | |
| | 1.4 1's and 2's complement methods of addition/subtraction | |
| 2. | Gates | (3 hrs) |
| | Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR gates | |
| | TTL circuit and C MOS Circuit | |
| 3. | Boolean Algebra | (5 hrs) |
| | 1.0 Boolean Relations | |
| | 2.0 DeMorgan's Law | |
| | 3.0 K-Map upto four variables | |
| 4. | Combinational Circuits | (8 hrs) |
| | 1.5 Half adder, Full adder | |
| | 1.6 Encoder, Decoder | |
| | 1.7 Multiplexer/Demultiplexer | |
| | 1.8 Display Devices (LED, LCD and 7-segment display) | |
| 5. | Flip-Flops | (6 hrs) |
| | 1.2 J-K Flip-Flop | |
| | 1.3 R-S Flip-Flop | |
| | 1.4 D-Type Flip-Flop | |
| | 1.5 T-Type Flip-Flop | |
| | 1.6 Applications of Flip-Flops | |

6. A/D and D/A Converters (4 hrs)
- 6.1 D/A converters (Binary weighted, R-2R D/A Converter)
- 6.2 A/D converter (Counter ramp, successive approximation method of A/D Conversion)
7. Semi-conductor Memories: (2 hrs)
Types, basic principles and their specifications
- (PART-B)
1. Microprocessor (20 hrs)
- 1.9 Study 8085 microprocessor architecture, pin configuration, bus organisation, registers flags, interrupts
- 1.10 Instruction set of 8085 microprocessor, addressing modes, instruction format. Writing some simple assembly language programmes. Use of stacks and sub-routines in programming
- 1.11 Interfacing and data transfer between peripheral, I/O and microprocessor
- 1.12 Study of peripheral chips – 8255, 8253, 9155
- 1.13 Introduction of 16-bit, 32-bit microprocessor, their advantages over 8-bit microprocessor
- 1.14 Concept of 8086 and 68000 microprocessors
2. Introduction to Microcontrollers (5 hrs)
- 2.4 Different between microprocessor and micro controller
- 2.5 Architecture of 8031 and 8051 varieties of microprocessor
3. Programmable Logic Controller (PLC) (6 hrs)
- 3.1 Introduction to PLC
- 3.2 Basic configuration of PLC
- 3.3 Comparison of logic controller

LIST OF PRACTICALS

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. Verification of operation of a 8-bit D/A Converter
5. Writing assembly language programme using nemoanics and test them on μ P Kit (any three)
 - e) Addition of two 8-bit numbers
 - f) Subtraction of two 8-bit numbers
 - g) Multiplication of two 8-bit numbers
 - h) Division of two 8-bit numbers
 - i) Finding average of N given integer
 - j) Finding maximum number out of three given numeric
6. Assembly language programming for different applications on 8051 microprocessor

7. Ladder diagram programming on PLC (any available version of PLC)

RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain
2. Digital Principles and Electronics by Malvino & Leach
3. Digital Electronics by RL Rokheine
4. Digital Electronics by SN Ali
5. Microprocessor by Goanker, Wiley Eastern Ltd. New Delhi
6. Digital Electronics by T.L. Foyal
9. Digital Electronics by Jamwal
10. Microprocessors Architecture, Programming and Application with 8085/8080A, RS Gaonkar, Wiley Eastern Ltd. New Delhi
11. Introduction to Microprocessors by Aditya Mathur, TMH Publishing Co., New Delhi

Note: Question paper will be set 50% from Part-A and 50% from Part-B.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Number Systems	4	5
2.	Gates	3	5
3.	Boolean Algebra	5	10
4.	Combinational Circuits	8	10
5.	Flip-Flops	6	10
6.	A/D and D/A converters	4	5
7.	Semi-conductor Memories	2	5
PART-B			
1.	Microprocessor	20	30
2.	Introduction to Microcontrollers	5	10
3.	Programmable Logic Controller	6	10
Total		64	100

ESTIMATING AND COSTING IN ELECTRICAL ENGINEERING

RATIONALE

A diploma holder in electrical engineering should be familiar to Indian Standards and relevant Electricity Rules. Preparation of good estimates is a professional job, which requires knowledge of materials and methods and the principles of economics. The contents of this subject has been designed keeping in view developing requisite knowledge and skills of estimation and costing in students of diploma in electrical engineering.

DETAILED CONTENTS

- | | | |
|----|--|--|
| 1. | Introduction | (10 hrs) |
| | Purpose of estimating and costing, Performa for making estimates, preparation of materials schedule costing, price list, tender document net price 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. Tenders – its constituents, finalization specimen tender. | |
| 2. | Types of wiring | (8 hrs) |
| | Electrical, batten, casing-casing and conduit wiring, comparison of different wiring, 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. | |
| 5 | Estimating and Costing: | (36 hrs) |
| | 3.1 | Estimating and costing of Earthing such as plate and pipe |
| | 3.2 | 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) |
| | 3.3 | 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, sizing of diagram, starters, preparation of materials lists, estimating and costing exercises on workshop with single-phase, 3-phase motor load and the light load (3-phase supply system) |
| | 3.4 | Service line connection estimate for domestic and Industrial loads (over-head and under ground connections) from pole to energy meter. Electrical forms: different types of fans and their sizes, air-conditioners, exhaust fans, determination of size and number of fans for a given situation. |
| 4. | Electrical Substation And Distribution Lines | (10 hrs) |

- a) Substation: Types of substations, substation schemes and components, estimate of 11/0.4 kV pole mounted substation up to 500 kVA rating.
- b) Foundation Mounted substation, Indoor type substations above 500 kVA rating.
- c) Transmission and distribution lines (overhead and underground) planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations

RECOMMENDED BOOKS

1. Electrical Estimating and Costing by JB Gupta, Satya Prakashan, New Delhi
5. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi
6. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi
7. Estimating and Costing by Qurashi
8. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi
9. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction	10	20
2.	Types of wiring	8	15
3.	Estimating and costing	36	50
4.	Electrical Substation And Distribution Lines	10	15
Total		64	100

MINOR PROJECT WORK

L T P
- - 4

Note: The project may be identified at the end of 4th semester

Rationale

Realising the great importance of students' exposure to world of work for his professional growth, two spells of industry oriented projects-minor and major have been included in the curriculum. It is necessary that teachers to play a pro-active role in planning and guidance of individual students for optimizing the benefits of the activity in stipulated time.

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to correlate concepts, principles and practices taught in the classroom with their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

Depending upon the interests of the students and location of the organization the student may be asked to:

- e) Study various types of materials being used
- f) Learn and Study various operations/processes
- g) Know about various measuring instruments and test equipment being used
- h) Study the plant layout and material handling in an industry
- i) Have knowledge about production planning and control in an industry
- j) Know about various quality control techniques and safety measures adopted
- h) Prepare list of specifications of equipment and machines used
- i) Disassembly and assembly of motors, transformers available in the industry
- j) Checking of wiring in the control panels

(This list is only suggestive ,however other problems may also be identified depending on local industries)
For effective planning and implementation of the above, it is suggested that polytechnics / institutes should:

- a) Identify adequate number of industrial/field organizations and seek their approval for deputing students for exposure/visits.
- b) Prepare a workbook (which can be used by students) for guiding students to perform definite task during the above mentioned exposure.
- c) Identify teachers who would supervise the students' activities and provide guidance on continuous basis during the above project work

The components of evaluation will include the following :

<u>Component</u>	<u>Weightage</u>
a) Punctuality and regularity	10%
b) Initiative in learning new things	10%
c) Relationship with others/workers	10%
d) Project Report/ Technical report	50%
e) Seminar based on Project	20%

GENERAL SKILL DEVELOPMENT CAMP - I

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 5th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centred Activities. It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Independent Study Technique
 - 1.1 Information search, information extraction, storage and retrieval
 - 1.2 Reading skills
 - 1.3 Life long learning
 - 1.4 Continuing education

2.
 - 2.1 Introduction
 - 2.2 Time Management
 - 2.3 Stress and emotions
 - 2.4 Health and hygiene

3. Task Management
 - 3.1 Task planning and organizing
 - 3.2 Task execution
 - 3.3 Task evaluation
 - 3.4 Event management

4. Action Research
 - 4.1 Importance and Scope
 - 4.2 Steps in action research
 - 4.3 Analysis of data
 - 4.4 Conclusions and report writing

UTILIZATION OF ELECTRICAL ENERGY

L T P
5 - -

RATIONALE

This subject assumes importance in view of the fact that a technician has to work in a wide spectrum of activities wherein he has to make selections from alternative schemes from technical and economical considerations; i.e. to plan and design using basic principles and handbooks, to select equipment, processes and components in different situations.

The curriculum has been designed keeping the above objectives in view. Besides giving them 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 students with 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

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Electric Drives: | (14 hrs) |
| 1.1 | Advantages of electric drives | |
| 1.2 | Characteristics of different mechanical loads | |
| 1.3 | Types of motors used in electric drive | |
| 1.4 | Electric braking | |
| | 1.4.1 Plugging | |
| | 1.4.2 Rheostatic braking | |
| | 1.4.3 Regenerative braking | |
| 1.5 | Methods of power transfer by direct coupling by using devices like belt drive, gears, pulley drives etc. | |
| 1.6 | Examples of selection of motors for different types of domestic loads | |
| 1.7 | Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel. | |
| 1.8 | Specifications of commonly used motors e.g. squirrel cage, slip ring induction motors, AC series motors, FKW motors | |
| 2. | Illumination: | (14 hrs) |
| 2.1 | Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light | |

- 2.2 Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux.
 - 2.3 Laws of illumination – simple numericals
 - 2.4 Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour lamp, fluorescent lamp, metal halide lamp, neon lamp, compact fluorescent lamps(CFL)
 - 2.5 Calculation of number of light points for interior illumination, calculation of illumination at different points, considerations involved in simple design problems. Illumination schemes; indoor and outdoor. Illumination levels
 - 2.6 Main requirements of proper lighting; absence of glare, contrast and shadow
 - 2.7 General ideas about street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.
3. Electric Heating (10 hrs)
- 3.1 Advantages of electrical heating
 - 3.2 Heating methods:
 - 3.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances and thermostat control circuit
 - 3.2.2 Induction heating; principle of core type and coreless induction furnace
 - a. Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace
 - b. Dielectric heating, applications in various industrial fields
 - c. Infra-red heating and its applications
 - d. Microwave heating
 - 3.3 Simple design problems of resistance heating element
4. Electric Welding: (10 hrs)
- 4.1 Advantages of electric welding
 - 4.2 Welding methods
 - 4.2.1 Principles of resistance welding, types – spot, projection seam and butt welding and welding equipments used
 - 4.2.2 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method of and their applications. Power supply required. Advantages of using coated

- electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper
- 4.3 Introduction to TIG, MIG Welding
5. Electrolytic Processes: (10 hrs)
- 5.1 Need of electro-deposition
 - 5.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing
 - 5.3 Equipment and accessories for electroplating
 - 5.4 Factors affecting electro-deposition
 - 5.5 Principle of galvanizing and its applications
 - 5.6 Principles of anodising and its applications
 - 5.7 Electroplating on non-conducting materials
 - 5.8 Manufacture of chemicals by electrolytic process
 - 5.9 Manufacturing of chemicals by electrolysis process
6. Electrical Circuits used in Refrigeration and Air Conditioning and Water Coolers: (10 hrs)
- 6.1 Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants
 - 6.2 Description of Electrical circuit used in
 - a) refrigerator,
 - b) air-conditioner, and
 - c) water cooler
7. Electric Traction: (12 hrs)
- 7.1 Advantages of electric traction
 - 7.2 Different systems of electric traction, DC and AC systems, diesel electric system, Electric Traction, types of services – urban, sub-urban, and main lines and their speed-time curves
 - 7.3 Different accessories for track electrification; such as overhead wire, conductor rail system, current collector-pentagraph
 - 7.4 Factors affecting scheduled speed
 - 7.5 Electrical block diagram of an electric locomotive with description of various equipment and accessories
 - 7.6 Types of motors used for electric traction
 - 7.7 Starting and braking of traction motors
 - 7.8 Introduction to EMU and metro railways

Note: Students should be taken for visits to the Railway track to study the electric traction system. A visit to nearby Railway electric locomotive repair shop will be very useful.

TEACHING STRATEGY

This subject requires demonstrations and exposure to actual workplace/industry/field. For this purpose, the subject teacher should do advance planning for visits/studies related to each topic in consultation with HOD and Principal of the polytechnic/institution.

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. A.Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
4. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi
5. Utilization of Electrical Energy by OS Taylor, Pitman Publications
6. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Electric Drives	14	20
2.	Illumination	14	20
3.	Electric Heating	10	10
4.	Electric Welding	10	10
5.	Electrolytic Processes	10	10
6.	Electrical circuits used in Refrigeration and Conditioning and Water coolers	10	10
7.	Electric Traction	12	20
Total		80	100

CONTROL OF ELECTRICAL MACHINES

L T P
4 - 2

RATIONALE

A diploma holder in industry is called upon to design and modify electrical control circuits. He is also required to carry out trouble shooting in control circuits. To achieve these skills it is necessary that he should be well conversant with various types of motor starters and control systems used in industry. Knowledge of static control of machines using Digital logic gates and programmable control of machines is also necessary as these are increasingly being used in industry today.

DETAILED CONTENTS

1. Basics of Control Systems: (2 hrs)
 Definitions of open loop, closed loop systems, block diagram, stability
2. Control Components : (10 hrs)
 Fuses, switches and fuse switch units, moulded case and miniature circuit breakers, contactors, contactor ratings, different types of relays, latching relay, frequency relays, Bimetallic Ratchet and Magnetic type overload relays. Thermal, pneumatic and electronic timers, phase failure relay (Single phase preventer), push button switches, drum switches, limit switches, speed actuating switches, solenoid valves, pressure switches, temperature switches, float switches, control transformer, symbols for various components, control diagrams.
3. Starters for 3 phase Squirrel Cage Induction Motors : (10 hrs)
 Introduction, motor current at starting and during running. Manual and automatic primary resistor, increment resistor, line reactor and auto-transformer starters. Closed circuit transition auto-transformer starter, star-delta starter (open circuit and closed circuit transition). Two speed two winding and one winding motor starters. Forward/reverse starter.
4. Starters for Wound Rotor Induction Motors (8 hrs)
 Induction motor current at start and during running, manual starter using master controllers, definite time limit starters using individual timer and motor driven cam timer for each step, secondary frequency acceleration starter.

5. Protection of Motor (6 hrs) 6
(6 hrs)
- Co-ordination of fuse, overload and contactor characteristics, Overload and short circuit protection, winding temperature protection, under voltage and phase failure protection.
6. Industrial Control Circuits (6 hrs)
- Introduction, planar machine, skip hoist, automatic control for a water pump, control of electrical ovens, overhead crane, battery operated truck, air compressor, conveyer system, elevator, trouble shooting in control circuits.
7. Static Control of Machines (10 hrs)
- Advantages and disadvantages of static control compared to magnetic control. Development of simple control circuits using logic gates, off-return and retentive memory elements. Input and output devices for solid state logic circuits. Study of some industrial control circuits like product dispersion, product inspection conveyer system etc. using shift registers, counters, decoder, mono shot, clock, down counter and encoder.
8. Programmable Logic Controllers (12 hrs)
- Parts of a programmable controller, inputs/output section, central processing unit, input image table, output image table, user program memory, variable data memory, complete scan cycle, the programming terminals, programming basics, relay, timer, Counter and Sequencer type instructions, analog operation.

LIST OF PRACTICALS

1. Study of some actual control drawings from industry.
2. Design and modification of control circuit as per required control requirements.
3. Wiring of different types of starters for three phase wound and squirrel cage induction motor.
4. Learning program entry and editing of PLC using Hand held programmer.
5. Learning program entry and editing on PLC through personal computer which is interfaced to PLC through a software package.
6. Writing, testing and debugging of simple programs to control the working of different components like motors, solenoid operated cylinder pistons, relays, flashers etc. using sensors on a PLC trainer.

INSTRUCTIONAL STRATEGY

This being a subject of practical nature, teacher may co-relate theory with practices in the industry. Students may be encouraged to perform practicals in the laboratory with their own involvement. Industrial visits may also be organized to demonstrate the electric motor control practically.

BOOKS RECOMMENDED

1. Control of Electrical Machines by S.K. Bhattacharya and Brijinder Singh. Tata McGraw Hill, New Delhi
2. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell Macmillan International editions.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic(s)	Time allotted (in hours)	Marks Allocation
1	Basics of Control System	2	5
2	Control Components	10	15
3	Starters for 3 phase squirrel cage Induction Motors	10	15
4	Starters for wound rotor Induction Motors	8	10
5.	Protection of Motor	6	10
6.	Industrial Control Circuits	6	10
7	Static Control of Machines	10	15
8.	Programmable Logic Controllers	12	20
	Total	64	100

ELECTRICAL POWER-II

(Power System Protection)

L T P
5 - -

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, principles involved in the construction and working of generating stations and protective switch gear system so that one can handle, install, maintain them and also take decisions at his/her level in different situations. The teaching of this subject requires reinforcement in the form of visits to substation, power stations and well designed test laboratory(ies). A practice-oriented approach to the teaching of this subject is suggested.

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Power System Faults | (16 hrs) |
| | Common type of faults in both overhead and underground systems
Types of faults, single line to ground, double line to ground, three phase to ground, open conductors, severity of faults and their effects on system, basics of fault calculations., Fault clearing process. | |
| 2. | Switch gears | (24 hrs) |
| | a) Purpose of protective gear. Difference between switch, isolator and circuit breakers. Function of isolator and circuit breaker. Making and breaking capacity of circuit breaker (only definition) | |
| | b) Circuit breakers. Principles of Arc extinction, Types of circuit breakers, bulk and minimum oil circuit breakers, air blast circuit breakers, SF ₆ circuit breakers, Vacuum Circuit Breakers(VCBs), circuit breaker time(Total Break Time), Circuit Breaker rating | |
| | c) Miniature circuit breakers,s ACB, ELCB, MCB, for distribution and transmission system (Description only) | |
| 3. | Protection Devices | (16 hrs) |
| | a) Fuses; function of fuse. Types of fuses, HV and LV fuses, rewire-able, cartridge type HRC fuse. | |
| | b) Earthing, purpose of earthing: neutral earthing, equipment earthing, substation earthing, transformer earthing, system earthing as per Indian Electricity rules and earth leakage Protection, earthing transformer, reactance earthing. | |
| | c) Relays: | |

- Introduction, types of relays. Electromagnetic and thermal relay, their construction and working
- Induction type over-current, earth fault relays, instantaneous over current relay
- Directional over-current, different relays their functions
- Idea of static relays and their applications
- Programmable Relays

4. Protective Relaying (6 hrs)
- a) Faults, causes, and effects
 - b) Importance of protective relaying and protective zones
 - c) Primary and back-up protection methods – time grading, duplication principle
 - d) Power Line carrier channel (PLCC)
 - e) System security and SCADA
5. Protection Schemes (10 hrs)
- a) Introduction to over current and earth fault protection
 - b) Basics of differential protection
 - c) Basics of distance protection
 - d) Protection of transmission lines: Directional Time and Current graded system, Earth fault protection schemes
 - e) Protection of transformers: Protection requirements and safety devices with power transformers, Buchholtz relay.
 - f) Protection of Generators: Abnormal conditions and protection system e.g. external faults, thermal overloading, unbalanced loading, status winding fault, Rotor, stator winding faults, excitation failure, over speed, reverse power
 - g) Substation protection: Bus protection by over current relays: Distance protection of incoming lines as a remote back-up
6. Transient Over Voltages: (8 hrs)
- a) Choice of insulation levels of substation equipment
 - b) Lightning, different types of lightning arresters
 - c) Traveling waves and surge absorbers, wave traps
 - d) Protection of rotating machines against over-voltage surges
 - e) Insulation coordination

RECOMMENDED BOOKS

1. Testing, Commissioning , Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Electrical Power Systems by CL Wadhwa, Wiley Eastern Ltd., New Delhi
3. Textbook of Electrical Technology by BL Theraja, S Chand and Co., New Delhi
4. Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi

5. A Course in Electrical Power by ML Soni, PV Gupta and Bhatnagar, Dhanpat Rai & Sons, New Delhi
6. Principles of Power Systems by VK Mehta, S Chand and Co., New Delhi
7. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Power System Faults	16	20
2.	Switch Gears	24	25
3.	Protection Devices	16	20
4.	Protection Relaying	6	10
5.	Protection Schemes	10	15
6.	Transient Over Voltages	8	10
Total		80	100

Elective -II

ENERGY MANAGEMENT

L T P
4 - -

RATIONALE

One of the reasons for India not been able to catch up with the desired extent of modernization of industrial processes in light of challenges posed by multinationals is the non-availability of required energy supply. The solution primarily lies in tapping all possible energy generation sources but efficient use of available energy is also important. Energy management focuses on these aspects and the course will develop a awareness amongst the diploma engineers and will enable them to practice the energy management techniques in whatever field they are engaged in.

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Energy Management | (12 hrs) |
| | <ul style="list-style-type: none"> 1.1 Overview of energy management, need for energy conservation, (effect of natural resources) Environmental Aspects, Alternative sources of energy, Rules of energy conservation Act 2002, Role of Energy Managers. 1.2 Need for Energy conservation with brief description of oil and coal crisis. 1.3 Environmental aspects 1.4 Alternate sources of energy. 1.1 Energy efficiency- its significance | |
| 2. | Energy Conservation | (12 hrs) |
| | <ul style="list-style-type: none"> 2.1 Energy conservation in Domestic Sector- Lighting, home appliances 2.2 Energy conservation in Industrial sector- Motors, Industrial lighting, Distribution system, Pumps, Fans, Blowers etc., 2.3 Energy conservation in Agriculture sector - Tubewell pumps, diesel-generating sets, standby energy sources viz Solar power system, Solar cookers, boilers and light etc 2.4 Macro Level approach for energy conservation at design stage. | |
| 3. | Energy Efficient Devices | (20 hrs) |
| | <ul style="list-style-type: none"> 3.1 Need for energy efficient devices 3.2 Initial cost versus life cycle, cost analysis on life cycle basis 3.3 Energy efficient motors as compared to standard motors. 3.4 BIS specification for energy efficient motors, Salient design features, 3.5 Efficiency as a function of load, safety margins 3.6 Energy efficient lighting system different sources, lumens/watt, LEDs, role of voltage on efficiency 3.7 Distribution system- Optimum cable size, amorphous core transformer, role of power factor, use of compensating capacitors-manual and automatic, location of capacitors. | |

4. Energy Audit (15 hrs) 12
- 4.1 Energy Audit Methodology
- 4.2 Efficiency of energy conversion processes, monitoring system
- 4.3 Specific energy consumption –three pronged approach, fine tuning, technical up gradation, avoidable losses.
- 4.4 gradation, avoidable losses.
- 4.5 Case studies of energy audit of distribution system, AC motors, Industries.
- 4.6 Organisation of energy audit activities.
5. Environmental impact assessment (05 hrs)
- 5.1 Need for Environmental impact Assessment
- 5.2 Standard format for assessment and its completion
- 5.3 Evaluation of the assessment.

RECOMMENDED BOOKS:

1. Manual on energy efficiency at design stage, CII energy management cell.
2. Manual on energy efficiency in pumping system, CII energy management cell.
3. Manual on variable speed drives for energy efficiency CII energy management cell.
4. Energy conservation case studies in ceramic industry, sugar industry, fertiliser industry, cement industry. CII, Energy Management Cell etc

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Energy Management	12	20
2.	Energy Conservation	12	20
3.	Energy efficient Devices	20	30
4.	Energy Audit	15	25
5.	Environmental impact assessment	5	5
Total		64	100

Elective -II

OPTICAL FIBRE COMMUNICATION

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4 - -

RATIONALE

Progressing from communication over copper wire to today's fibre optic communication, we have increase our ability to transmit more information, more quickly and over longer distances. This has expanded our boundaries and it finding a good slot in communication system. It is replacing the old technology. Operational fiber optical systems are now in common and new installations and applications appear continually. The growth is expected to continue for many year. Basic concepts of optical fibre communication have been dealt in this subject.

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction | (8 hrs) |
| | Historical perspective, basic communication systems, optical frequency range, advantages optical fibre communication, application of fibre optic communication | |
| 2. | Light Wave Fundamentals | (10 hrs) |
| | Nature of light, acceptance angle and numerical aperture, electromagnetic waves, dielective wave guide, modes in planar guide dispersion and distortion in wave guide. | |
| 3. | Optical Fibre Wave guides | (10 hrs) |
| | Fibre structure, step-index fibre, graded – index fibre, attention, modes in step, index and graded index fibres, pulse dispersion and information rate in optical fibres construction of optical fibres, optic fibre cables. | |
| 4. | Light Sources | (8 hrs) |
| | Light emitting diodes (LEDs), Operating characteristics of LEDs, Laser principles, Laser diodes, Operating characteristics of laser-diodes, distributed feedback laser diode, optical amplifier, fibre laser. | |
| 5. | Light Detectors | (8 hrs) |
| | principles of photodetection, photo multiplier semiconductor photodiode, PIN diode and avalanche photodiode. | |
| 6. | Optical Fibre Joints | (8 hrs) |
| | Fibre cabling, Fibre jointing | |
| | Fibre, alignment and joint loss, fibre end preparation, splices, connectors, source coupling. | |
| 7. | Distribution Networks and Fibre Components | (10 hrs) |

Distribution network, directional couplers, star couplers, Switches fibre optical isolators, attenuators, wave length division multiplexing, Fibre detectors

RECOMMENDED BOOKS

1. Optical Fibre Communication by Joseph. C. Palais, Pearson Education Publications, Published by Addison Wesley Longman (Singapore) Pte. Ltd., Delhi.
2. Optical Fibre Communication and its Applications by S.C.Gupta, Prentice Hall India – New Delhi.
3. Fibre-Optic Communication Systems by G.P. Agrawal; John Wiley and Sons, New Delhi.
4. Optical Fibres Communication, by John M. Senior, Prentice Hall India, New Delhi.
5. Optical Communication Systems by J. Gower; Prentice Hall India, New Delhi.
6. Optical Fibre Communication by Gerd Keiser; MC Graw Hill, International Editions.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction	8	10
2.	Light Wave Fundamentals	10	20
3.	Optical fibre Waveguides	10	20
4.	Light Sources	8	10
5.	Light Detectors	8	10
6.	Optical Fibre Joints	8	10
7.	Distribution Networks and fibre Components	10	15
Total		64	100

Elective-II

MODERN ELECTRIC TRACTION SYSTEM

L T P
4 - -

RATIONALE

Now a days electrical energy finds major application in electric traction besides diesel locomotives. Therefore a diploma holder is required to have elementary knowledge of electric drives used in traction and their accelerating and breaking arrangements.

DETAILED CONTENTS

- | | | |
|----|---|---------|
| 1. | Introduction | (4 hrs) |
| | <ul style="list-style-type: none"> 1.1. Electric Traction System. 1.2. Advantages over other system 1.3. Types of electric traction systems 1.4. Choice of traction system in India 1.5. Historical background of track electrification in India. | |
| 2. | System of Tract Electrification | (6 hrs) |
| | <ul style="list-style-type: none"> 2.1 Single phase low frequency System. 2.2 Three phase low frequency system 2.3 Composite System 2.4 Disadvantages of Single phase to d.c. System 2.5 Comparison between pure a.c. and d.c system. | |
| 3. | Track Mechanics | (8 hrs) |
| | <ul style="list-style-type: none"> 3.1 Types of services (Urban, Suburban and Mainline) 3.2 Speed time curve 3.3 Tractive effort and traction effort speed characteristics 3.4 Power of traction motor 3.5 Specific energy consumption 3.6 Mechanics of train movement, co-efficient 3.7 Factors affecting slip. 3.8 Simple numerical problems. | |
| 4. | Power Supply arrangement | (8 hrs) |
| | <ul style="list-style-type: none"> 4.1 Constituents of Power supply system i.e. substation 4.2 Sectioning and paralleling post. 4.3 Subsection and post 4.4 Sub-sectioning post and elementary sections 4.5 Major control posts or switching substations 4.6 Major equipment of substations. | |
| 5. | Equipment used in and outside the Locomotive | (8 hrs) |
| | <ul style="list-style-type: none"> 5.1 Block diagram of Locomotive | |

- 5.2 Overhead equipment
 - 5.3 Section Insulator
 - 5.4 Polygon OHE
 - 5.5 Supporting structure
 - 5.6 Current collector
 - 5.7 Circuit breaker
 - 5.8 Tap changer
 - 5.9 Transformer
 - 5.10 Rectifier connections
 - 5.11 Smoothing reactors
6. Traction Motors and Traction Motor Control (8 hrs)
- 6.1 Desirable characteristic of traction motors.
 - 6.2 Comparative study of characteristic of Induction motor.
 - 6.3 Linear induction motor and their suitability for traction applications.
 - 6.4 Series parallel control of traction motors.
 - 6.5 Advantages of series parallel control
 - 6.6 Simple numerical problems
7. Braking (8 hrs)
- 7.1 Requirements of braking system.
 - 7.2 Types of brakes (Mechanical, hydraulic, magnetic and eddy current)
 - 7.3 Electrical braking – plugging
 - 7.4 Rheostatic and Regenerative braking.
8. Train Lighting (8 hrs)
- 8.1 Systems of train lighting
 - 8.2 Special requirements of train lighting
 - 8.3 Single Battery system
 - 8.4 Double Battery parallel block systems
 - 8.5 Principal equipment of Double Battery system
 - 8.6 Modified Train Lighting System
 - 8.7 Silicon Blocker Rectifier
 - 8.8 End on generation.
9. Railway Coach Air-conditioning (6 hrs)
- 9.1 Electrical equipment for power generation and accessories for control of air conditioning equipment.
 - a) Motor generator set
 - b) Star-delta starter and pre-cooling plug socket
 - c) Compressor – condenser and air conditioning unit motors
 - d) Main control panel.
 - e) Batteries
 - 9.2 Circuit explanation of schematic diagram for air conditioning equipment.
 - 9.3 Starting of plant when coach is stationary and when no ac supply is available.
 - 9.4 Starting the plant when coach is running and the generator is generating.

INSTRUCTIONAL STRATEGY

Since the subject is field oriented and there is no laboratory arrangement in polytechnic. The students should be taken to locomotive yard, railway workshops to show the working in actual. This exposure will reinforce theory taught.

RECOMMENDED BOOKS

1. Art and Science of utilization of electrical energy by H. Partab, Dhanpat Rai and Sons, Delhi
2. Modern Electric Traction by Partab, Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Introduction	4	5
2.	System of Tract Electrification	6	10
3.	Track Mechanics	8	10
4.	Power Supply arrangement	8	15
5.	Equipment used in and outside the locomotive	8	15
6.	Traction Motors and Traction Motor Control	8	15
7.	Braking	8	15
8.	Train Lighting	8	15
9.	Railway Coach Air-conditioning	6	10
Total		64	100

ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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4 - -

RATIONALE

Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/ vocational stream students to start their own small scale business/enterprise. Since diploma technicians are expected to take-up middle level managerial positions, their exposure to basic management principles is very essential. Based on the broad competencies listed above, following detailed contents have been finalized to develop the appropriate competencies.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| (1) | Entrepreneurship | (10 hrs) |
| | 1.1 Concept/Meaning and its need | |
| | 1.2 Competencies/qualities of an entrepreneur | |
| | 1.3 Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institutes (SISIs), Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State and national level | |
| (2) | Market Survey and Opportunity Identification (Business Planning) | (10 hrs) |
| | 2.1 How to start a small scale industry | |
| | 2.2 Procedures for registration of small scale industry | |
| | 2.3 List of items reserved for exclusive manufacture in small scale industry | |
| | 2.4 Assessment of demand and supply in potential areas of growth | |
| | 2.5 Understanding business opportunity | |
| | 2.6 Considerations in product selection | |
| | 2.7 Data collection for setting up small ventures | |
| (3) | Project Report Preparation | (08 hrs) |
| | 3.1 Preliminary Project Report | |
| | 3.2 Techno-Economic feasibility report | |
| | 3.3 Project Viability Report | |
| (4) | Managerial Aspects of Small Business | (10 hrs) |

- 4.1 Principles of Management, Definitions, functions of management viz planning, organization, coordination and control
- 4.2 Structure of an industrial organization.
- 4.3 Basic principles of financial management
- 4.4 Marketing Techniques
- 4.5 Personnel Management, staff development and training strategies
- 4.6 Importance and techniques of communication in business
- (5) Legal Aspects of Small Business (10 hrs)
 - 5.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules, provident fund
 - 5.2 Elementary knowledge of Factory Act, 1948 and Payment of Wages Act 1936, Workmen Compensation Act, Industrial Dispute act 1947, Employees State Insurance Act 1978
- (6) Environmental Considerations (04 hrs)
 - 6.1 Concept of ecology and environment
 - 6.2 Factors contributing to Air, Water, Noise pollution
 - 6.3 Air, water and noise pollution standards and control
 - 6.4 Norms and standards of State pollution Board
 - 6.5 Disaster Management – basic idea
- (7) Miscellaneous (12 hrs)
 - 7.1 Human resource development in an organization
 - 7.2 Motivation – Incentives, Rewards, Job Satisfaction
 - 7.3 Leadership- types, qualities, functions and factors of effective leadership
 - 7.4 Labor Welfare schemes including wage payment- types, system of wage payment and incentives
 - 7.5 Workers participation in management, case studies in effective Management.
 - 7.6 Accident and Safety: Classification, precaution and treatment after accident, safety practices promotion, personal protection equipment (PPFs) for safety at work places.
 - 7.7 Introduction to Total Quality Management (TQM) and steps to achieve this.
 - 7.8 Intellectual Property Rights (IPR): Concept, definition, infringements and remedies related to patents, copy rights, trademarks, designs. Introduction to registering procedure

INSTRUCTIONAL STRATEGY

The aim of this subject is to develop conceptual understanding by giving inputs and exposure about starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Industrial management by N. Mohan, and AP Verma, SK Kataria and Sons, Nai Sarak, Delhi-110006
9. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
10. Principles of Management by Philip Kotler TEE Publication
11. Intellectual Property Rights and the Law by Dr. GB Reddy.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Entrepreneurship	10	10
2.	Market Survey and Opportunity Identification (Business Planning)	10	20
3.	Project Report Preparation	08	10
4.	Managerial Aspects of Small Business	10	15
5.	Legal Aspects of Small Business	10	15
6.	Environmental Considerations	04	10
7.	Miscellaneous	2	20
Total		64	100

MAJOR PROJECT WORK

(Industry oriented – Practice based)

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- - 12

Project work aims at developing professional skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of a practical problem undertaken as a project work. The students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be explained the objectives of the project work and then asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments. The project assignment can be individual or a group assignment. There should preferably be not more than 4 students if the project work is given to a group. The students should identify themselves or be given project assignment at least two to three months in advance. The identified project work must lead to students exposure and interaction with industry/field organizations in the world of work.

Each teacher is expected to guide the project work of 4-5 students at a time. The project assignments may consist of :

- a) Projects related with repair and maintenance of machine parts
- b) Estimating and costing projects
- c) Design of components/ parts/ jigs / fixtures
- d) Projects related to quality control
- e) Project work related to increasing productivity
- f) Project connected with work study
- g) Projects relating to erection, installation, calibration and testing
- g) Projects related to wastage reduction
- h) Projects related to energy audit

For Students of Electrical Engineering Diploma Programme the project work can be grouped under the following five groups. A number of projects have been mentioned under each group. A student should take at least two projects both of which should not be from the same group. If more than two projects are taken to make up a total of 160 hours, then more than 1 may be taken from the same group as long as at least two groups are covered.

NOTE:

It is pointed out that the specific projects mentioned below under each group are only suggestions and the same may not necessarily be done. The teachers may choose and undertake any other project within these groups provided they are approved by a committee headed by the head of the department. It will be appreciated if teachers take initiative in developing projects of their own and also encourage the students to do the same. When such projects are added to the following list the number of hours required should be estimated before hand for each of the projects.

1.1 Electrical Machines and Equipment:

- 1.1.1 Construction of a small transformer (500 VA or so)
- 1.1.2 Construction of phase sequence indicator
- 1.1.3 Construction of hot air drier
- 1.1.4 Construction of a Simple loop generator
- 1.1.5 Design and fabrication of Automatic curtain operator
- 1.1.6 Construction of Automatic Star-Delta starter
- 1.1.7 Construction of Automatic Water level controller
- 1.1.8 Balancing of load of an indoor distribution transformer
- 1.1.9 Construction of Choke for fluorescent tubes
- 1.1.10 Design and construction of fan regulators (inductance type)
- 1.1.11 Design and construction of fan regulators (Resistance type)
- 1.1.12 Design and construction of loading rheostats
- 1.1.13 Design and construction of Desert coolers
- 1.1.14 Fabrication of electric motor (FKW)
- 1.1.15 Rewinding of motors upto 5 HP
- 1.1.16 Design and construction of Geysers
- 1.1.17 Electroplating of small domestic gadgets
- 1.1.18 Erection/installation and commissioning of rotating electrical machine
- 1.1.19 Fault detection and repair of electrical/electronic instruments
- 1.1.20 Design and assembly of contactor control circuit for various applications

1.2 Electrical Power:

- 1.2.1 Drawing, estimating and costing of electrical installation of the institution from supplier's pole to the institution distribution board. Drawing, estimating and costing of electrical installation of a workshop having a given number of electrically operated appliances/machines.
- 1.2.2 To lay underground distribution cable for a small colony starting from main distribution pole
- 1.2.3 To erect a 5 pole span overhead line for a small distance for distribution of electrical energy. To energize it and prepare list of material and cost estimates.
- 1.2.4 To provide a service connection to a consumer's premises for domestic purposes
- 1.2.5 To survey the load of given area in a village, small colony, calculate the effective load and find out the sizes of the cables/conductors for the proposed distribution system
- 1.2.6 Designing of light and fan scheme for a institutional or commercial building
- 1.2.7 Augmentation of a nearby pole mounted sub station

1.3 Electronic Based Projects:

Fabrication of:

- 1.3.1 Voltage Stabilizer for refrigerator, air-conditioner
- 1.3.2 Emergency light using SCR
- 1.3.3 Power amplifier
- 1.3.4 Low cost intercom for home
- 1.3.5 Analog computer
- 1.3.6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906

- 1.3.7 Automatic battery charger using SCR
 - 1.3.8 Battery operated tube light
 - 1.3.9 Solid state fan regulator
 - 1.3.10 Burglar Alarm
 - 1.3.11 Hearing aid
 - 1.3.12 Automatic street light/dressing table light
 - 1.3.13 Mosquito Repeller
 - 1.3.14 Inverter circuit 500- 1000 watt.
- 1.4 Power Electronics based projects
- Fabrication and Testing of:
- 1.4.1 Inverter/Emergency light circuit using power transistors
 - 1.4.2 SCR based automatic battery charger
 - 1.4.3 SCR operated illumination controller
 - 1.4.4 SCR operated automatic water level controller
 - 1.4.5 SCR based speed controller for DC shunt motor
 - 1.4.6 Three phase full wave rectifier using power diodes
 - 1.4.7 Timer circuit using 555-IC
 - 1.4.8 SCR controlled rectifier circuit
 - 1.4.9 Speed control circuit of DC shunt motor using SCR
 - 1.4.10 Inverting and non-inverting amplifiers using OP AMP(741)
 - 1.4.11 Comparator circuits using OP AMP (741)
- 1.5 Market Survey for Different Types of Electrical Items with Specifications
- 1.5.1 MCBs
 - 1.5.2 Iron clad Main Switch Electrodes
 - 1.5.3 Accessories including wires and cables used for household installation
 - 1.5.4 Special purpose Cables, Teflon, paper insulated etc.
 - 1.5.5 Starters for three phase and single phase induction motors of different makes(eg. Seimens, Crompton Greaves, Havels, Hind Electrical etc).

Note:

The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max. marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10	10	8	6	4	2
2.	Planning and execution of considerations	10	10	8	6	4	2
3.	Quality of performance	20	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self expression/communication skills	5	5	4	3	2	1
7.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
Total marks		100	100	80	60	40	20

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

The teachers are free to evolve another criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.

GENERAL SKILL DEVELOPMENT CAMP-II

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 6th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centred Activities. It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Ethics and Values
 - 1.1 Introduction and importance
 - 1.2 Ethics and values in profession and society
 - 1.3 Dignity of labour
 - 1.4 Net etiquettes

2. Group Dynamics
 - 2.1 Introduction
 - 2.2 Leadership
 - 2.3 Communication in group
 - 2.4 Team work

3. Personality Development
 - 3.1 PR technique
 - 3.2 Positive attitude
 - 3.3 Self-esteem
 - 3.4 Creativity

4. SWOT Analysis
 - 4.1 Importance
 - 4.2 Introduction to SWOT analysis steps
 - 4.3 SWOT analysis parameters