Curriculum for

Diploma Programme in

ELECTRICAL ENGINEERING (INDUSTRIAL CONTROL)

For the State of Uttar Pradesh

Prepared by:

IRDT, Kanpur

May, 2019

Approved and Implemented by B.T.E,U.P
(Effective from session 2019-20)

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PREFACE

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION,U.P,LUCKNOW IN MEETING HELD ON 10.07.2019 @RASHMI SONKAR

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new t echnologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomena lly during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries a nd field organizations. The initiatives being taken by the Technical Education, UP to revise the existing curricula of 12 diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements o f future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome -based curricula of diploma programmes. The curricula for diploma programmes have been revised by a dopting time -tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curricul um document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implem entation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Manoj Kumar
Director
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vii) Faculty/SubjectExperts from U.P. Government polytechnics

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1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING (Industrial Control)

1)	Name of the Programme	:	Diploma Programme in Electrical Engineering (Industrial Control)
2)	Duration of the Programme	:	Three years (Six Semesters)
3)	Entry Qualification	:	Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4)	Intake	:	60 (or as prescribed by the Board)
5)	Pattern of the Programme	:	Semester Pattern
6)	NSQF Level	:	Level - 5
7)	Ratio between theory and *Practice*	:	50 : 50 (Approx.)

8) Industrial Training:

Four weeks of industrial training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.

9) Ecology and Environment :

As per Govt. of India directives, a subject on Envi ronmental Studies has been incorporated in the curriculum.

10) Energy Conservation:

A subject on Energy Conservation has been incorporated in the curriculum.

11) Entrepreneurship Development:

A full subject on Industrial Management and Entrepreneurship Development has been incorporated in the curriculum.

12) Student Centred Activities:

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A provision of 3-6 periods per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co –curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

13) Project work

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

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2. EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN ELECTRICAL ENGINEERING

(A) EMPLOYMENT OPPORTUNITIES

Keeping present scenario in view following employment opportunities are visualized in different sectors of employment for diploma holders in Electrical Engineering (Industrial Control)

(1) Manufacturing Industry

The Electrical diploma holder will be able to execute following activities:

- Planning and execution for Electrical installation
- Electrical installations and Maintenance of DG Set
- Electrical Power Distribution and Maintenance
- Maintenance of Industrial Electrical System
- Repair and Maintenance of Electrical Machines and Equipment
- Quality Control for Electrical systems
- Energy Conservation
- Assistance in Research and Development
- Assistance in Planning, Designing and Detailing
- Shop-floor Management
- Electrical Safety Measures
- Estimate for Electrical Installation
- Inventory Management
- Marketing and Sales
- Use of PLC and Microcontrollers.

(2) Government Departments such as Electricity Board, MES, PWD, Railways, Air bases, Airports, Defence, Thermal, Hydro and Nuclear Power Stations and other Boards and Corporations

The Electrical diploma holder will be able to execute following type of activities in above mentioned Government Departments:

- Assistance in Planning and Design of Electrical generation, transmission, distribution and protection system including testing, quality control
- Estimating for electrical installation
- Construction, erection and commissioning of lines and Sub-stations
- Electrical Safety measures
- Operation and Maintenance of Lines and Sub-stations/underground cables
- Tariffs and Calculations of bills for consumption of electricity
- Inventory Management
- Repair and Maintenance of Electrical Machines/ Equipment
- Assist in Operation and maintenance of Generating and sub-stations
- Preventive maintenance and condition monitoring
- Programming of PLC
- Electric Traction Systems
- Chemical, pharma, Process Engg.

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(3) Hospitals, Commercial Complexes, Service Sector Organizations like Hotels, Tourist -Resorts, high -rise buildings, Cinema/Theater Halls etc.

The diploma holder in electrical engineering will be involved in following type of activities in above mentioned Service Sector Organizations:

- Layout of wiring circuit, planning and execution for Electrical Installation
- Standby or captive Power Generation and its Distribution
- Maintenance of Electrical and E lectronic Equipment
- Preventive maintenance of Electrical Systems of Lifts, Air -Conditioning Plants etc.
- Inventory Management
- Estimation for electrical repair and maintenance work

(4) Self Employment

Following type of self employment opportunities are availab le to the diploma holder in electrical engineering:

- Trading of Electrical Goods
- Establishing Repair and Maintenance Unit/ Centre
- Free Lancer for Repair and Maintenance of House -hold Electrical and Electronic Gadgets such as: Washing Machines, Geysers, A ir Conditioners, Coolers and electrical installations etc.
- Electrical contractor
- Motor Winding Unit
- Auto -electrical Work
- Service sector (AMC)
- Microcontroller based systems for different applications

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3. LEARNING OUTCOMES OF THE PROGRAMME

Sr. No.	Learning Outcomes
After due completion of the course, a diploma holder in Electrical Engineering will be able to:	
1.	Communicate effectively in English with others
2.	Apply basic principles of mathematics to solve engineering problems
3.	Apply basic principles of physics and chemistry to solve engineering problems
4.	Prepare computerized reports, presentations using IT tools and computer application software
5.	Prepare and interpret drawings of engineering components
6.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work
7.	Use energy conservation methods in various systems
8.	Use appropriate procedures for preventing environmental pollution and energy conservation
9.	Analyze AC circuits and apply electromagnetic induction principles in various electrical equipments and machines
10.	Test various active and passive components like resistor, inductor, capacitor, diode, transistor and use them as an amplifier and voltage stabilizer
11.	Select and use right kind of quality of electrical material required for a particular operation
12.	Plan and execute given task/project as team member/le
13.	Read and interpret drawings related to electrical machines, equipment and wiring installation
14.	Assemble distribution and extension boards and construct alarm and indicating circuits using relays, bells and push buttons
15.	Operate and maintain DC shunt, series and compound motors and three phase transformer
16.	Use measuring instruments, tools and testing devices for varied field applica tions
17.	Repair and maintain UPS and storage batteries and control speed of DC shunt motor and universal motor
18.	Design and use flip-flops, A/D and D/A converters in digital circuits Design Sequential and asequential circu
19.	Use MATLAB, SCILAB for designing and finding solutions to problems related to electrical systems
20.	Programme and develop microcontroller based systems
21.	Use of PLC and make suitable ladder logic programmes for different applic
22.	Understand various control system devices and component, performance of various controllers and control syste
23.	Operate and demonstrate microcontroller and PLC based systems in electrical control circuits for domestic and industrial proces
24.	Design cable trenches, lay underground cables and find faults in transmission/ distribution syste
25.	Understand different types of Microprocessor and their applications

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26.	Plan and execute minor projects related to electrical engineering
27.	Handle electrical energy based equipments for electric traction systems
28.	Manage resources effectively at the workplace
29.	Use measuring instruments for measurement of electrical or non -electrical quantities
30.	Handle Control Components , Conventional electromagnetic controllers, conventional and solid state control of electric m/c and electric drives
31.	Troubleshoot various auto electrical faults
32.	Apply all the knowledge and skill gained through various courses in solving a live problem/project in the industry
33.	Test and install various electrical equipment and machines

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4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	Communication Skill
2.	Apply basic principles of mathematics to solve engineering problem	Applied Mathematics
3.	Apply basic principles of physics and chemistry to solve engineering problems	– Applied Physics – Applied Chemistry
4.	Prepare computerized reports, presentations using IT tools and computer application software	Basics of Information Technology
5.	Prepare and interpret drawings of engineering component	Engineering Drawing
6.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	General Workshop Practice
7.	Use energy conservation methods in various systems	Energy Conservation
8.	Use appropriate procedures for preventing environmental pollution and energy conservation	Environmental Studies
9.	Analyse AC circuits and apply electromagnetic induction principles in various electrical equipment's and machines	Basic Electrical Engineering
10.	Test various active and passive components like resistor, inductor, capacitor, diode, transistor and use them as an amplifier and voltage stabilizer	Analog Electronics
11.	Select and use right kind of quality of electrical material required for a particular operation.	Electrical and Electronics Engineering Materials
12.	Plan and execute given task/project as team member/leader	Project work
13.	Read and interpret drawings related to electrical machines, equipment and wiring installations	Electrical Design, Drawing and Estimating
14.	Assemble distribution and extension boards and construct alarm and indicating circuits using relays, bells and push button	General Workshop Practice
15.	Operate and maintain DC shunt, series and compound motors and three phase transformer	Electrical Machine

16.	Use measuring instruments, tools and testing devices for varied field applications	Installation , Maintenance and Repair of Electrical Equipment
17.	Repair and maintain UPS and storage batteries and control speed of DC shunt motor and universal motor	Industrial Electronics and Control
18.	Design and use flip -flops, A/D and D/A converters in digital circuits Design Sequential and asequential circuits	DIGITAL PRINCIPLES AND ELECTRONICS
19.	Use MATLAB, SCILAB for designing and finding solutions to problems related to electrical systems	Applications of Computer Software in Electrical Engineering
20.	Programme and develop microcontroller based systems	Programmable Logic Control, Microcontroller and SCADA
21.	Use of PLC and make suitable ladder logic programmes for different applications	Programmable Logic Control, Microcontroller and SCADA
22.	Understand various control system devices and component, performance of various controllers and control system	CONTROL SYSTEM & PROCESS APPL ICATION
23.	Operate and demonstrate microcontroller and PLC based systems in electrical control circuits for domestic and industrial processes	Programmable Logic Control, Microcontroller and SCADA

24.	Design cable trenches, lay underground cables and find faults in transmission/ distribution system	– Installation Maintenance and Repair of Electrical Equipment – Transmission and Distribution of Electrical Power
25.	Understand different types of Microprocessor and their applications	MICROPROCESSORS DEVELOPMENT SYSTEM
26.	Plan and execute minor projects related to electrical engineering	Project work
27.	Handle electrical energy based equipment's for electric traction systems	Utilization of Electrical Energy
28.	Manage resources effectively at the workplace	– Industrial Management and Entrepreneurship Development – Utilization of Electrical Energy – Energy Conservation
29.	Use measuring instruments for measurement of electrical or non -electrical quantities	Electrical Instrumentation and Measurement

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30.	Handle Control Components, Conventional electromagnetic controllers, conventional and solid-state control of electric m/c and electric drives	INDUSTRIAL CONTROL
31.	Troubleshoot various auto electrical faults	Repair of Electrical Equipment
32.	Apply all the knowledge and skill gained through various courses in solving a live problem/project in the industry	Project Work
33.	Test and install various electrical equipment and machines	Installation , Maintenance and Repair of Electrical Equipment

5. ABSTRACT OF CURRICULUM AREAS

a) General Studie

1. Communication Skill
2. Environmental Studies
3. Energy Conservation
4. Industrial Management and Entrepreneurship Development

b) Applied Scienc

5. Applied Mathematics
6. Applied Physics
7. Applied Chemistry

c) Basic Courses in Engineering/Technol

8. Engineering Drawing
9. Basics of Information Technology
10. General Workshop Practice
11. Basics of Mechanical and Civil Engineering

d) Applied Courses in Engineering/Techno

12. Basic Electrical Engineering
13. Analog Electronics
14. Electrical Instrumentation and Measurement
15. Electrical and Electronics Engineering Materials
16. Digital Electronics
17. Electrical Machine
18. PLC, Microcontroller and SCADA
19. Electrical Design, Drawing and Estimating
20. Control System & Process Application
21. Transmission and Distribution of Electrical Power
22. Switchgear and Protection
23. Industrial Electronics and Control
24. Installation, Maintenance and Repair of Electrical Machines
25. Industrial Control

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26. Utilization of Electrical Energy

27. Microprocessors Development System

28. Industrial Training

29. Project Work

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	Communication Skill	6	-	-	6	-	-
2.	Applied Mathematics	5	5	5	-	-	-
3.	Applied Physics	7	7	-	-	-	-
4.	Applied Chemistry	7	-	-	-	-	-
5.	Engineering Drawing	8	-	-	-	-	-
6.	Basics of Information Technolo	6	-	-	-	-	-
7.	GeneralWorkshop Practice	8	8	-	-	-	-
8.	Basic Electrical Engineering	-	9	-	-	-	-
9.	Basics of Mechanical and Civil Engineering	-	7	-	-	-	-
10.	Analog Electronics	-	8	-	-	-	-
11.	Electrical Instrumentation and Measuremen	-	-	10	-	-	-
12.	Electrical and Electronics Engineering Material	-	-	6	-	-	-
13.	Digital Principles And Electronics	-	-	9	-	-	-
14.	Electrical Machine	-	-	10	-	13	-
15.	Environmental Studies	-	-	5	-	-	-
16.	PLC, Microcontroller and SCADA	-	-	-	-	12	-
17.	Microprocessor Developmen System	-	-	-	11	-	10
18.	Control System & Process Application	-	-	-	5	-	-
19.	Transmission and Distribution of Electrical Power	-	-	-	7	-	-
20.	Energy Conservation	-	-	-	5	-	-
21.	Industrial Management and Entrepreneurship Developme	-	-	-	-	5	-
22.	Switchgear and Protection	-	-	-	-	6	-
23.	Industrial Electronics and Control	-	-	-	10	-	-
24.	Universal Human Values				3		
25.	IndustrialControl	-	-	-	-	10	-
26.	Installation, Maintenance and Repair of Electrical Equipmen	-	-	-	-	-	12
27.	Utilization of Electrical Energy	-	-	-	-	-	5
28.	Applications of Computer Software in Electrical Engineerin	-	-	-	-	-	6
29.	Project work	-	-	-	-	-	12
30.	Student Centred Activities	1	4	3	1	2	3
Total		**48**	**48**	**48**	**48**	**48**	**48**

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7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING

FIRST SEMESTER

Sr No.	SUBJECT	STUDY SCHEME Periods/We			Credits	MARKS IN EVALUATION SCHEME							Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSME				
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot
1.1	*Communication Skill-1	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
1.2	*Applied Mathematics-1	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
1.3	*Applied Physics-1	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.4	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.5	*Engineering Drawing-I	-	-	8	2	-	40	40	60	3			60	100
1.6	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
1.7	General Workshop Practice-I	-	-	8	2	-	40	40			60	4	60	100
#Student Centred Activities		-	-	1	1	-	30	30	-	-	-	-	-	30
Total		19	-	29	25	80	180	260	260	-	180	-	440	700

* Common with other diploma programmes

\# Student Centred Activities will comprise co-curricular activities like extension activities, games, hobby clubs e.g. photography etc., seminars, declamation contests educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics -II	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
2.2	*Applied Physics-II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.3	Basic Electrical Engineering	5	-	4	5	20	10	30	50	2 ½	20	3	70	100
2.4	**Basics of Mechanical and Civil Engineering	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.5	Analog Electronics	4	-	4	5	20	10	30	50	2 ½	20	3	70	100
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100
#Student Centred Activities		-	-	4	1		30	30	-	-	-	-	-	30
Total		24	-	24	27	100	110	210	250	-	140	-	390	600

* Common with other diploma programmes

** Common with diploma in Chemical Engg.

Student Centred Activities will comprise co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study

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THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & Externa
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
3.2	Electrical Instrumentation and Measurement	6	-	4	6	20	20	40	50	2 ½	40	3	90	130
3.3	Electrical and Electronics Engineering Materials	6	-	-	5	20	-	20	50	2 ½	-	-	50	70
3.4	Digital PrinciplesAnd Electronics	5	-	4	5	20	20	40	50	2 ½	40	3	90	130
3.5	Electrical Machine- I	6	-	4	6	20	20	40	50	2 ½	40	3	90	130
3.6	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
#Student Centered Activities including Energy Conservation Awareness		-	-	3	2		30	30	-	-	-	-	-	30
Total		31	-	17	31	120	100	220	300	-	140	-	440	660

* Common with other diploma programmes

\# Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clube.g. photography etc., seminars, declamation con, educationalfield visits, N.C.C., NSS, Cultural Activities and self study etc.

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FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skill- II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	Industrial Electronics and Control	5	1	4	6	20	20	40	50	2 ½	40	3	90	130
4.3	Electrical Design, Drawing and Estimating-I	3	-	8	5	20	20	40	50	3	40	4	90	130
4.4	Control System& Process Application	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
4.5	Transmission and Distribution of Electrical Power	6	1	-	5	20	-	20	50	2 ½	-	-	50	70
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
4.7	Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50
# Student Centred Activities		-	-	1	1	-	30	30	-	-	-	-	-	30
Total		28	2	18	30	120	110	230	300	-	150	-	450	680

Note: Industrial Training for 4 weeks after fourth semester during summer vacation.

Student Centred Activities will comprise of co-curricular activitieslike extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

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FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods /Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
-	Industrial Training	-	-	-	2	-			-	-	50	3	50	50
5.1	*Industrial Management and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
5.2	Switchgear andProtection	5	1	-	5	20	-	20	50	2 ½	-	-	50	70
5.3	PLC, Microcontroller and SCADA	6	-	6	7	20	35	55	50	2 ½	70	3	120	175
5.4	Electrical Machine – II	6	1	6	8	20	35	55	50	2 ½	70	3	120	175
5.5	INDUSTRIAL CONTROL	6	-	4	7	20	30	50	50	2 ½	50	3	100	150
#Student Centred Activities(SCA)		-	-	2	2	-	30	30	-	-	-	-	-	30
Total		28	2	18	35	100	130	230	250	-	240	-	490	720

* Common with other diploma programme s

\# Student Centred Activities will comprise of co -curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests , educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

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SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods /Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Installation, Maintenance and Repair of ElectricalEquipment	6	-	6	7	20	35	55	50	2 ½	70	3	120	175
6.2	MICROPROCESSORS DEVELOPMENT SYSTEM	6	-	4	7	20	20	40	50	3	40	4	90	130
6.3	Utilization of Electrical Energy	5	-	-	4	20	-	20	50	2.5	-	-	50	70
6.4	Application of Computer Software in Electrical Engineering	-	-	6	2	-	20	20	-	-	30	3	30	50
6.5	Project Work	-	-	12	5	-	50	50	-	-	100	3	100	150
#Student Centred Activities		-	-	4	2	-	30	30	-	-	-	-	-	30
Total		17	-	32	27	60	155	215	150	-	240	-	390	605

Student Centred Activities will comprise of co -curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests , educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 10 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)

ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	2 Marks
b)	80 - 85%	4 Marks
c)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co -curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	State/National Level participation
b)	10	-	Participation in two of above activities
c)	5	-	Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

1.1 COMMUNICATION SKILLS– I

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L	T	P
4	-	2

RATIONALE

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

LEARNING OUTCOMES

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

.

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with approp riate format
- Read unseen texts with comprehension

.

DETAILED CONTENTS

1 Basics of Communication (13 periods)

1.1 Definition and process of communication
1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal
1.3 Communications barriers and how to overcome them
1.4 Barriers to Communication, Tools of Communication

2 Application of Grammar (18 periods)

2.1 Parts of Speech (Noun, verb, adjective, adverb) and modals
2.2 Sentences and its types
2.3 Tens es
2.4 Active and Passive Voice
2.5 Punctuation
2.6 Direct and Indirect Speech

3 Reading Skill (10 periods)
Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be cov ered under this topic)

4 Writing Skill (15 periods)

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4.1 Picture composition
4.2 Writing paragraph
4.3 Notice writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.
Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught i n a project oriented manner where the learning happens as a byproduct.

Listening and Speaking Exercises

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book -I by RevathiSri nivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English -R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.

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7. E-books/e -tools/relevant sof tware to be used as recommended by AICTE/UPBTE/NITTTR.

Websites for Reference:

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	13	24
2	18	32
3	10	16
4	15	28
Total	**56**	**100**

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1.2 APPLIED MATHEMATICS-I

L	T	P
5	-	-

RATIONALE

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

LEARNING OUTCOMES

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

- Apply Binomial theorem to solve engineering problems
- Apply determinants properties and Crammer's rule to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems
- Use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- Find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

DETAILED CONTENTS

1. Algebra-I (12 Periods)

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

   1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.

   1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule

2. Algebra-II (12 Periods)

   2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.

   2.2 Complex number.
   Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. Trigonometry (10 Periods)

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3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relationship between sides and angle of a triangle.

3.2 Inverse circular fun ctions: Simple case only

4. Differential Calculus - I (18 Periods)

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

4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logaritimic differentiation, Differentiation of Inverse trigonom etric function, Differentiation of implicit functions.

5. Differential Calculus - II (18 Periods)

5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.

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

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSME NT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	12	20
2.	12	20
3.	10	12
4	18	24
5	18	24
Total	**70**	**100**

1.3 APPLIED PHYSICS-I

L	T	P
5	-	2

RATIONALE

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

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

LEARNING OUTCOMES

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

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

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DETAILED CONTENTS

1. Units and Dimensions (10 Periods)

1.1 Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)

1.2 Dimensions and dimensional formulae of ph ysical quantities.

1.3 Principle of homogeneity of dimensions

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

1.5 Limitations of dimensional analysis

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

1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc (at least two each).

2. Force and Motion (10 periods)

2.1 Scalar and vector quantities – examples, representation of vector, types of ve ctors

2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.

2.3 Resolution of Vectors and its application to lawn roller.

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

2.5 Impulse and its Applications

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

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

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

2.9 Applic ation of various forces in lifts, cranes, large steam engines and turbines

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3. Work, Power and Energy (10 periods)

3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non -conservative force ,
3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.
3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
3.6 Power and its units, calculation of power in numerical problems
3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

4 Rotational Motion (10 periods)

4.1 Concept of t ranslatory and rotatory motions with examples
4.2 Definition of torque with examples
4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples
4.4 Moment of inertia and its physical significance, radius of gyration for rig id body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.
4.5 Rotational kinetic energy, Rolling of sphere on the slant plane
4.6 Comparison of linear motion and rotational motion.
4.7 Application of rotational motions in transport vehicles, and machines.

5 Motion of planets and satellites (08 periods)

5.1 Gravitational force, Kepler's law of planetary motion
5.2 Acceleration due gravity and its variation
5.3 Gravitational Potential and Gravitational potential energy
5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity
5.5 Types of satellites, Geo -stationary satellite, semi -synchronous, polar satellite (concept only) and their uses in science and technology
5.6 Concept of Black Holes

6. Properties of Matter (12 periods)

6.1 Elasticity: definition of stress and strain, different types of modulii of elasticity, Hooke's law, significance of stress strain curve
6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and i ts applications

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

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

6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theor em and their applications.

7. Heat and Thermodynamics (10 periods)

7.1 Difference between heat and temperature

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

7.3 Different scales of temperature and their relationship

7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them

7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co -efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.

7.6 Isothermal and Adibatic process

7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.

7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS

1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both verniercalipers and screw gauge.

2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.

3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer

4 To verify parallelogram law of forces

5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.

6 To find the Moment of Inertia of a flywheel about its axis of rotation

7 To determine the atmospheric pressure at a place using Fortin's Barometer

8 To determine the viscosity of glycerin by Stoke's method

9 To determine the coefficient of linear expansion of a metal rod

10 To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

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

MEANS OF ASSEMENTS

– Assignment & Quiz,

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- Mid -Term and End -Term written test,
- Model Making,
- Actual Lab & Practical Work,
- VivaVoice

RECOMM ENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	10	15
3	10	15
4	10	15
5	08	10
6	12	16
7	10	14
Total	**70**	**100**

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1.4 APPLIED CHEMISTRY

L	T	P
5	-	2

RATIONALE

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

LEARNING OUTCOMES

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

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critica lly, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and the ir relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select p olymer/rubber/plastic materials for engineering applications.

DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)

    1.1 Fundamental particles - mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.

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

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1.3 Atomic number, atomic mass number isotopes and isobars.

1.4 Definition of orbit and orbitals , shapes of s and p orbitals only, quantum numbers and their significance,

1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements wi th atomic number greater than 30 are excluded).

1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)

1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma (σ) and pi (π) covalent bonds in H_2, HCl, Cl_2, elementary idea of hybridization in $BeCl_2$, BF_3, CH_4, NH_3 and H_2O, VSEPR, Molecular orbital Theory

1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding - explanation with the help of electron gas (sea) model.

2. Fuels and Lubricants (18 periods)

2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels

2.2 Calorific value -higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.

2.3 Coal - types of coal and proximate analysis of coal

2.4 Fuel rating – Octane numbe r and Cetane number, fuel -structural influence on Octane and Cetane numbers

2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.

2.6 Elementary ideal on – hydrogen as fut ure fuels, nuclear fuels.

2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.

2.8 Synthetic lubricants and cutting fluids.

3. Water (14 periods)

3.1 Demonstration of water resources on Earth using pie chart.

3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.

3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water. Primming and foaming and caustic embrittlement in boilers.

3.4 Removal of hardness -Permutit pr ocess and Ion -exchange process.

3.5 Physico -Chemical methods for Water Quality Testing

a) Determination of pH using pH meter, total dissolved solids (TDS)

b) Testing and Estimation of - alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).

c) Understanding of Indian Water Quality standards as per WHO

3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.

3.7 Municipality waste w ater treatment. Definition of B.O.D and C.O.D.

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4. Electrochemistry (4 periods)

Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrobytes); Nernst equation.

5. Corrosion and its Control (10 periods)

5.1 Definition of corrosion and factors affecting corrosion rate.
5.2 Theories of
a) Dry (chemical) corrosion - Pilling Bedworth rule
b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism
5.3 Definition of passivity an d galvanic series
5.4 Corrosion control:
a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel –Application of Metal Zn (Sheradizing),Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage
b) Inorganic coatings – Anodizing and phosphating,
c) Organic coatings - use of paints varnishes and enamels
d) Internal corrosion preventive measures - alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

6. Organic compounds, Polymers and Plastics (10 periods)

6.1 Classification of organic compounds and IUPAC Nomenclature
6.2 Definition of polymer, monomer and degree of polymerization
6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)
6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics
6.5 Applications of polymers in industry and daily life

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

Teachers may tak e help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be

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encour aged or motivated to study those processes in more details, which may find practical application in their future professional career.

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1.	14	20
2.	18	24
3.	14	20
4.	4	6
5.	10	15
6.	10	15
Total	**70**	**100**

1.5 ENGINEERING DRAWING - I

L	T	P
-	-	8

RATIONALE

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

Note:

i) First angle projection is to be followed
ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD
iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

LEARNING OUTCOMES

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

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

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DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)

   1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.
   1.2 Different types of lines in Engineering drawing as per BIS specifications
   1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing in struments.
   1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ra tio of 7:4

2. Dimensioning Technique (01 sheet)

   2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
   2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches

3. Scales (02 sheets)

   3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale
   3.2 Drawing of plain and diagonal scales

4. Orthographic Projections (06 sheets)

   4.1 Theory of orthographic projections (Elaborate theoretical instructions)
   4.2 Projection of Points in different quadrant
   4.3 Projection of Straight Line (1 st and 3 rd angle)
      4.3.1. Line parallel to both the planes
      4.3.2. Line perpendicular to any one of the reference plane
      4.3.3. Line inclined to any one of the reference plane.
   4.4 Projection of Plane – Different lamina like square, r ectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1 st angle only
   4.5 Three views of orthographic projection of different objects. (At least one sheet in 3 rd angle)
   4.6 Identification of surfaces

5 Projection of Solid (02 sheets)

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5.1. Definition and salient features of Solid
5.2. Types of Solid (Polyhedron and Solid of revolution)
5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.

6. Sections (02 sheets)

6.1 Importance and salient features
6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
6.4 Orthographic sectional views of different objects.

7. Isometric Views (02 sheets)

7.1 Fundamentals of isometric projections and isometric scale.
7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.

8. Common Symbols and Conventions used in Engineering (02 sheets)

8.1 Civil Engineering sanitary fitting symbols
8.2 Electrical fitting symbols for domestic interior installations

*9. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

*** Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus s hould be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Sep arate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

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RECOMMENDED BOOKS

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

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1.6 BASICS OF INFORMATION TECHNOLOGY

L	T	P
-	-	6

RATIONALE

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

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

LEARNING OUTCOMES

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

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

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Introduction to Computers and Peripherals.

   Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD,Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sha ring of Printers.

2. Operation System and Application Software

   System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/Libreoffice, Working with window, Desktop components, Menu bars, creating shortcut of program. Installation of Application softwares, Antivirus and Drivers.

3. Word Processing, Spreadsheet and Presentation

   Usage and creation of word document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc. Google p resentation)

.

4. Internet

   Basics of Networking – LAN, WAN, Wi -Fi technologies, Concept of IP Addrsses, DNS, Search Engines, e -mail, Browsing and cyber laws.

LIST OF PRACTICAL EXERCISES

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

. 9. Word Processing (MS Office/Open Office)

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

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

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

   d) Formatting a document:
      - Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using di fferent underline methods

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- Aligning of text in a document, justification of document, inserting bullets and numbering
- Formatting paragraph, inserting page breaks and column breaks, line spacing
- Use of headers, footers: Inserting footnote, end note, use of comments, autotext
- Inserting date, time, special symbols, importing graphic images, drawing tools

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

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

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

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

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

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

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

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

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

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

a) Introduction to PowerPoint

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

b) Addition, deletion and saving of slides

c) Insertion of multimedia elements
- Adding text boxes
- Adding/importing pictures
- Adding movies and sound
- Adding tables and charts etc.
- Adding organizational chart
- Editing objects
- Working with Clip Art

d) Formatting slides
- Using slide master
- Text formatting
- Changing slide layout
- Changing slide colour scheme
- Changing background
- Applying design template

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi

4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon an d Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Info rmation Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net…Set…Go… Surviving in an e -world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vi pin Arora, Eagle Parkashan, Jalandhar

Reference websites

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

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1.7 GENERAL WORKSHOP PRACTICE-II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

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RATIONALE

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

LEARNING OUTCOMES

After completing the course, the students will be able to:

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

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 practice d. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop
4. Welding Shop
5. Plumbing Shop

1. CARPENTRY SHOP

1.1 General Shop Talk

1.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials

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1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C -Clamp, Chisels, Mallets, Carpente r's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.

1.1.3 Specification of tools used in carpentry sho p.

1.1.4 Different types of Timbers, their properties, uses & defects.

1.1.5 Seasoning of wood.

1.2. Practice

1.2.1 Practices for Basic Carpentry Work

1.2.2 Sawing practice using different types of saws

1.2.3 Assembling jack p lane — Planning practice including sharpening of jack plane cutter

1.2.4 Chiselling practice using different types of chisels including sharpening of chisel

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

1.3 Job Practice

Job 1	Marking, sawing, planning and chiselling and their practice
Job II	Half Lap Joint (cross, L or T – any one)
Job III	Mortise and Tenon joint (T -Joint)
Job IV	Dove tail Joint (Lap or Bridle Joint)

1.4. Dem onstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

2. PAINTING AND POLISHING SHOP

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

2.2. Job Practice

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

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

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

The sequence of polishing will be as follows:

i) Abrasive cutting by leather wheel

ii) Polishing with hard cotton wheel and with polishing material

iii) Buffing with cotton wheel or buff wheel.

3. ELECTRICAL SHOP

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

3.2 Study of electrical safety measures and protective devices.

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

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

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

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

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

3.5 Introduction to battery charger and its functioning.

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

4. WELDING SHOP

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

4.2 Job Practice

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

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

Job III Preparation of lap joint using arc welding process.

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

5. PLUMBING SHOP

5.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.

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

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

5.4. Job Practice

Job 1 : Preparation of job using elbow, bend and nipple

Job II: Preparation of job using Union, Tap, Plug and Socket.

Jo b III: Threading practice on pipe with die

MEANS OF ASSESSMENT

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- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Ba sic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

2.1 APPLIED MATHEMATICS- II

L	T	P
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RATIONALE

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

LEARNING OUTCOMI

Afterundergoing this course, the students will be able to:

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

DETAILED CONTENTS

1. Integral Calculus- I (20 Periods)

Methods of Indefinite Integrati

1.1 Integration by substitution.
1.2 Integration by rational function.
1.3 Integration by partial fraction.
1.4 Integration by parts.
1.5 Integration of special function

2. Integral Calculus- II (20 Periods)

2.1 Meaning and properties of definite integrals, Evaluation of definite integrals.
2.2 Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.
2.3 Simposns 1/3rd and Simposns 3/8th rule and Trapezoidal Rule : their applic in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton -Raphson's method (without proof), Numerical solutions of simultaneous equations; Gauss elimination method (without proof)

3. Co-ordinate Geometry (2 Dimension) (18 Periods)

3.1 Circle

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

4. Co -ordinate Geometry (3 Dimension) (12 Periods)

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

INSTRUCTONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

MEANS OF ASS ESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	20	28
2.	20	28
3.	18	24
4	12	20
Total	**70**	**100**

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2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

RATIONALE

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

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

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1. Wave motion and its applications (12 periods)

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

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

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

1.4 Free, Damped and forced oscillations, Resonance with examples, Q -factor

1.5 Definition of pitch, loudness, quality and intensity of so und waves, intensity level, Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Accoustics of building defects and remedy.

1.6 Ultrasonics –production, detection, properties and applications in engineering and medical applications.

2. Wave Optics (6 periods)

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

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

2.3 use of interference making highly efficient solar panel.

2.4 diffraction, Single Slit diffract ion, Intensity calculation etc

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

3. Electrostatics (12 periods)

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

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

3.3 Capacitor and its working principle, Capacitance and its units. C apacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals), charging and discharging of a capacitor.

3.4 Dielectric and its effect on capacitance, dielectric break down.

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

4. Current Electricity (12 periods)

4.1 Electric Current, Resistance, Specific Resista nce, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting

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Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.

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

4.3 Concept of terminal potential difference and Electro motive force (EMF), potentiometer.

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

4.5 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio -Video System, Computers etc.

5. Magneto Statics and Electromagnetism (12 periods)

5.1 Magnetic poles, force on a moving charge, circulating charges, force on a current carrying wire, Hall effect, torque on a current loop.

5.2 Magnetic field due to moving charge(Biot -Savart Law), due to current (Biot - Savart Law), parallel currents, field of a solenoid, Ampere's law.

5.3 Faraday's law, Lenz' law, motional emf, induced electric fields.

5.4 Magnetic dipole and force on a magnetic dipole in a non -unif orm field, Magnetization, Gauss' law for magnetism.

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

5.6 Application of electromagnetism in ac/dc motors and generators.

6. Semiconductor physics (8 periods)

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

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

6.3 Se miconductor transistor, pnp and npn (concepts only)

6.4 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.

7. Modern Physics (8 Periods)

7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He -Ne lasers, engineering and medical applications of lasers.

7.2 Fibre optics: Total interna l reflection and its applications, Critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture, types and applications of optical fibre in communication.

7.3 Introduction to nanotechnology, nanoparticles and nano materials,

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To find the focal length of convex lens by displacement method .

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

INSTRUCTIONAL STATREGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	18
2	6	8
3	12	18
4	12	16
5	12	16
6	8	12
7	8	12
Total	**70**	**100**

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2.3. BASIC ELECTRICAL ENGINEERING

L	T	P
5	-	4

RATIONALE

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

LEARNING OUTCOMES

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

- **Identify and able to take readings on various electrical equipments(voltmeter, ammeter, CRO, wattmeter, multimeter)**
- **Determination of voltage-current relationship in a DC circuit under specifi c physical conditions**
- **Measure resistance of an ammeter and a voltmeter**
- **Verify DC circuits (Thevenin, Nortons, Superposition theorem, Maximum P Transfer Theorem)**
- **Verify Kirchhoff's Current and Voltage Laws in a dc circuit**
- **Find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance**
- **Test a lead- acid storage battery**
- Measure power and power factor in a single phase R-L-C. Circuit and calculation fo active and reactive powers in the circuit.
- Measure voltages and currents in polyphase a.c. circuits for star ard delta connections.

DETAILED CONTENTS

1. Overview of DC Circuits (08 periods)

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

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

2. DC Circuit Theorems (06 periods)

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

3. Voltage and Current Sources (04 periods)

3.1 Concept of voltage source, symbol and graphical representation characteristics of ideal and practical sources.
3.2 Concept of current sources, symbol, charact eristics and graphical representation of ideal and practical current sources.
3.3 Inter Conversion of Voltage -Source and Current Source.

4. Electro Magnetic Induction (10 periods)

4.1 Concept of electro -magnetic field produced by flow of electric current, magnetic circuit, concept of magneto -motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit. \
4.2 Faraday's laws of electro -magnetic induction, principles of self and mutual induction, self and mutually induced e.m. f, simple numerical problems.
4.3 Concept of current growth, decay and time constant in an inductive (RL) circuit.
4.4 Energy stored in an inductor, series and parallel combination of inductors.

5. Batteries (08 periods)

5.1 Basic idea of primary and secondary cells
5.2 Construction, working principle and applications of Lead -Acid, Nickel - Cadmium and Silver -Oxide batteries
5.3 Charging methods used for lead -acid battery (accumulator)
5.4 Care and maintenance of lead -acid battery
5.5 Series and parallel connections of batteries
5.6 General idea of solar cells, solar panels and their applications
5.7 Introduction to maintenance free batteries

6. AC Fundamentals (10 periods)

6.1 Concept of alternating quantities
6.2 Difference between ac and dc
6.3 Concepts of: cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor a nd peak factor.
6.4 Representation of sinusoidal quantities by phasor diagrams.
6.5 Equation of sinusoidal wave form for an alternating quantity and its derivation
6.6 Effect of alternating voltage applied to a pure resistance, pure inductance and pure capacitance.

7. AC Circuits (18 periods)

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7.1 Concept of inductive and capacitive reactance
7.2 Alternating voltage applied to resistance and inductance in series.
7.3 Alternating voltage applied to resistance and capacitance in series.
7.4 Introduction to series and parallel resonance and its conditions
7.5 Power in pure resistance, inductance and capacitance, power in combined RLC circuits. Power factor, a ctive and reactive power and their significance, definition and significance of power factor.
7.6 Definition of conductance, susceptance, admittance, impedance and their units
7.7 Introduction to polyphase a.c. systems, advantages of polyphase system over single phase system. Relations between line and phase value of voltages and currents for star and delta connections and their phasor diagram, power in polyphase circuits.

8. Various Types of Power Plants (06 periods)

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

LIST OF PRACTICALS

1. Operation and use of measuring instruments viz voltmeter, ammeter, CRO, Wattmeter, multi-meter and other accessories
2. Determination of voltage -current relationship in a dc circuit under specific physical conditions and to draw conclusions.
3. Measurement of resistance of an ammeter and a voltmeter
4. Verification of dc circuits:
   a. Thevenin's theorem,
   b. Norton's theorem,
5. Observation of change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
6. Verification of Kirchhoff's Current and Voltage Laws in a dc circuit
7. To find the ratio of inductance of a coil having air -core and iron -cor e respectively and to observe the effect of introduction of a magnetic core on coil inductance
8. Charging and testing of a lead - acid storage battery.
9. Measurement of power and power factor in a single phase R -.L-.C. circuit and calculation of active and reactive powers in the circuit.
10 Verification of line to line and line to neutral voltages and current in star and delta connections.

Note: Visit to a nearby Power Station(s) may be arranged to demonstrate various aspects of subject

INSTRUCTIONAL STRATEGY

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Basic electrical engineering being a fundamental subject, it needs to be handled very carefully and in a manner such that students develop clear understanding of the related concepts and principles. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self-study and problem solving abilities amongst them.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentation
- Model Making

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods)	Marks Allotted (%)
1.	08	11
2.	06	09
3.	04	06
4.	10	14
5.	08	11
6.	10	14
7.	18	26
8	06	09
Total	**70**	**100**

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2.4 BASICS OF MECHANICAL AND CIVIL ENGINEERING

L	T	P
5	-	2

RATIONALE

Apart from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementry Mech. Engg. to impart some necessary knowledge and skill about mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical and civil technici intermingled with either civil or mechanical engineering. As such the relevant basics of these disciplines are included in the content of the subject.
Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

LEARNING OUTCOMES

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

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

SECTION A- MECHANICAL ENGINEERING

DETAILED CONTENTS

1. Thermal Engineering (14 periods)

1.1 Sources of Energy

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work.Zeroth law of thermodynamics

Basic ideas, conventional and nonconventional forms- Thermal, Hydel, Tidal, wind, Solar, Biomass and Nuclear and their uses.

1.2 Fuels & Combustion:

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

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

2. Machine Com ponents (20 periods)

Brief i dea of loading on machine components.

(i) Pins, Cottor and Knuckle Joints.

(ii) Keys, Key ways and spline on the shaft.

(iii)Shafts, Collars, Cranks, Eccentrics.

(iv) Couplings and Clutches.

(v) Bearings -Plane, Bushed, Split -step, ball, Roller bearing, Journal bearing, Foot step bearing, thrust bearing, collar bearing and Special type bearings and their applications.

(vi) Gears

Different types of gears, gear trains and their use for transmission of motion. Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound an d epicyclic gear trains and their use. Definition of pitch and pitch circle & module.

(vii) Springs

Compression, Tension, Helical springs,Torsion springs, Leaf and Laminated springs. Their use and material.

3. Lubrication (08 periods)

Different lubrication system for lubricating the components of machines.

Principle of working of wet sump and dry sump system of lubrication. (Explain with simple line diagram). Selection of lubricant base d on different application (Requirement with the help of manufacturer catalogue).

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SECTION B : CIVIL ENGINEERING

4. Construction Materials (06 periods)

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

5. Foundations (08 periods)

5.1 Bearing capacity of soil and its imporance

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

6. Concrete (08 periods)

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

7. RCC (06 periods)

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

Note: 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 by organized demonstrations for explaining various concepts and principles.

LIST O F PRACTICALS

1. Study and Sketch of Pins and Cottor
2. Study and Sketch of Keys and Key ways
3. Study and sketch of Couplings andClutches
4. Study and Sketch of Bearings
5. Study and Sketch of Springs
6. Study of green energy
7. Testing of bricks
   a) Shape and size
   b) Soundness te st
   c) Water absorption
   d) Crushing strength
8. Testing of concrete
   a) Slump test
   b) Compressive Strength of concrete cube

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9 The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on basic principles and use charts in class, visits to labs and industry may be arranged to demonstrate certain materials and practices.

MEANS OF ASSESSMENT

- Sessional Tests
- End term Tests
- Practicals
- Viva -Voce

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	14	20
2.	20	28
3.	08	12
4	06	08
5	08	12
6	08	12
7	06	08
Total	**70**	**100**

2.5 ANALOG ELECTRONICS

L	T	P
4	-	4

RATIONALE

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

In thi s course, topics like semi -conductor Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers and field effect transistors have been included.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Use P.N. jun ction as rectifier
- Use Zener diode as voltage stabilizer
- Use bi -polar transistors and its application as an amplifier and as a switch
- Analyse amplifier and enhance the gain of amplifier
- Use unipolar transistors as amplifier
- Identify and testing of variou s active and passive components such as resistor, inductor, capacitor, diode and transistor

DETAILED CONTENTS

1. Semiconductor Diodes (12 periods)

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

   1.2 Ideal diode, Semiconductor diode characteristics, static and dynamic r esistance

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

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

   1.5 Diode ratings/specifications

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

1.7 Zener diode and its chara cteristics

1.8 Use of zener diode for voltage stabilization

2 Bi-polar Transistors (06 periods)

2.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow

2.2 Transistor configurations: common base (CB), c ommon emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations

3. Transistor Biasing and Stabilization (10 periods)

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

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

3.3 Concept of h -parameters of a transistor

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

4. Single -Stage Transistor Amplifiers (10 periods)

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

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

4.3 Concept of DC and AC load line

4.4 Voltage gain of single stage transistor amplifier using characteristics of the devic e

4.5 Concept of input and output impedance

4.6 AC equivalent circuit of single stage transistor amplifiers

4.7 Calculation of voltage gain using AC equivalent circuit

4.8 Frequency response of a single stage transistor amplifier

5. Multi -Stage Transistor Amplifiers (10 periods)

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

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

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

5.4 Loading effect in multistage amplifiers

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

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

6. Field Effect Transistor (FET) (08 periods)

6.1 Construction, ope ration, characteristics and applications of a N channel JFET and P channel JFET

6.2 JFET as an amplifier

6.3 Types, construction, operation, characteristics and applications of a MOSFET

6.4 Comparison between BJT, JFET and MOSFET

LIST OF PRACTICALS

1. a) Identific ation and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits
   b) Measurement of resistances using multimeter and their comparison with colour code values
2. To plot V -I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance
3. a) To plot 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 of relationship between dc and ac input voltage
6. Observation of input and output wave shapes of a full wave rectifier with (i) shunt capacitor) (ii) series inductor (i ii) 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.

INSTRUCTIONAL STRATEGY

This subject gives the knowledge of fundamental concepts of basic electronics. The teacher should give emphasis on understanding of concepts and various term used in the subject. The students be made familiar with diodes, transistors, resistors, capacitors, inductors etc. and electrical measuring instruments etc. Practical exercises will reinforce various concepts.

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Application of Semiconductor Diodes, Transistors, Field Effect Transistors etc m ust be told to students.

MEANS OF ASSESSMENT

- Assignments and quiz/class Tests
- Midterm and End -term tests
- Laboratory and Practical work
- Presentations
- Viva -Voce

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	12	21
2	06	11
3	10	18
4	10	18
5	10	18
6	08	14
Total	**56**	**100**

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2.6 GENERAL WORKSHOP PRACTICE –II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

L	T	P
-	-	8

RATIONALE

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

LEARNING OUTCOMES

After completing the course, the students will be able to:

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

DETAILED CONTENTS (PRACTICAL EXERCISES)

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 foll owing shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1 Fitting Shop
2 Sheet Metal Shop
3 Mason Shop
4 Machine Sho p

1. FITTING SHOP

1.1 Use of personal protective equipment and safety precautions while working.
1.2 Basic deburring processes.

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1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
1.5 Identification of various steel sections (flat, angle, channel, bar etc.).
1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).
1.7 Job Practic e

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).
Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of ±.25 mm.
Job III Makin g a cut -out from a square piece of MS flat using hand hacksaw and chipping
Job IV Drilling and tapping practice on MS Flat.

2. SHEET METAL SHOP

2.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
2.2 Introduction and demonstration of hand tools used in sheet metal shop.
2.3 Introduction and demonstration of various machines a nd equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,
2.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black -plain sheet, galvanized -iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
2.5 Study of various types of nuts, bolts, rivets, screws etc.
2.6 Job Practice

Job I: Shearing practice on a sheet using hand shears.
Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.
Job III :Pra ctice on making Single cover plate chain type, zig -zag type and single rivetted Butt Joint.

3 MASON SHOP

3.1. Introduction and importance of Mason shop
3.2. Introduction of tools, equipment and machines used in Mason shop

3.3. Job Practice
Job I : Preparation of simple bond
Job II : Preparation of Arched bond
Job III: Preparation of RCC structure (column and beam)

4 MACHINE SHOP

4.1 Study and sketch of lathe machine
4.2 Study and Sketch of grinders, milling ma chine, drilling machine and CNC machine.

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4.3 Plain and step turning and knurling practice.
4.4 Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Work shop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

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3.1 APPLIED MATHEMATICS III

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RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Matric (16 Perio

1.1 Algebra of Matrices, Inverse
Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.
Definition and Computation of inverse of a matrix.

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

1.3 Linear Dependence, Rank of a Matrix
Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equation

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

2. Differential Calculus (15 Periods)

2.1 Function of two variables, identification of surfaces in space, conicoids
2.2 Partial Differentiation

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

2.3 Vector Calculus

Vector function, Introduction todouble and triple integral,differentiation and integration of vector fu nctions, gradient, divergence and curl, differential derivatives.

3. Differential Equation (15 Periods)

3.1 Formation, Order, Degree, Types, Solution

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, nonlinear equation.

3.2 First Order Equations

Variable seperable, equations reducibl e to seperable forms, Homogeneous eqution s, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation :

Property of solution, Linear differential equation with constant coefficients (PI for $X = e^{ax}$, Sinax, Cosax, X^n, $e^{ax}V$, XV

3.4 Simple Applications

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

4. Integral Calculus -II (12 Periods)

4.1 Beta and Gamma Functions

Definition, Use, Relation between the two, their use in evaluating integrals.

4.2 Fourier Series

Fourier series of f(x), -n<x<n, Odd and even function,Half range series.

4.3 Laplace Transform

Definition, Basic theorem and properties, Unit step and Periodic functions, inverse laplace transform, S olution of ordinary differential equations

5. Probability and Statistics (12 Periods)

5.1 Probability

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution

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

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. The basic elements of Laplace transform, Differen tial equations and Applications of differential equations can be taught with engineering applications of relevant branch.

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MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	16	24
2.	15	20
3.	15	20
4	12	18
5	12	18
Total	**70**	**100**

3.2 ELECTRICALINSTRUMENTATION AND MEASUREMENT

L T P
6 - 4

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RATIONALE

Diploma holders in Electrical Engineering have to work on various jobs in the field as well as in testing laboratories and on control panels, where he performs the duties of installation, operation, maintenance and testing by measuring instruments. Persons working on control panels in power plants, substations and in industri es will come across the use of various types of instruments and have to take measurements.

Instruments used to read and observe the general electrical quantities like current, voltage, power, energy, frequency, resistance etc and their wave shapes, have b een incorporated in this subject. So the technician will know the construction and use of various types of electrical instruments.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

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

DETAILED CONTENTS

1. Introduction to Electrical Measuring Instruments: (05 Periods)

    1.1 Concept of measurement and instruments
    1.2 Concept ofmeasurement of electrical quantities and instruments for their measurements, sou rces of error.
    1.3 Types of electrical measuring instruments – indicating, integrating and recording type instruments
    1.4 Essentials of indicating instruments – deflecting, controlling and damping torque

2. Ammeters and Voltmeters (Moving coil and moving iron type) (06 Periods)

    2.1 Concept of ammeter and voltmeters and difference between them
    2.2 Construction and working principles of moving Iron and moving coil instruments

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

3. Wattmeters (Dynamometer Type) (06 Periods)

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

4. Energymeter (10 Periods)

4.1 Induction Type : Construction, working principle, merits an d demerits of single - phase and three -phase energy meters
4.2 Errors and their compensation
4.3 Simple numerical problems
4.4 Construction and working principle of maximum demand indicators

4.5 Digital energy meter (diagram, construction and applica tion)

5. Miscellaneous Measuring Instruments: (18 Periods)

5.1 Construction, working principle and application of Meggar, Earth tester(analog and digital) Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp -on meter)
5.2 Instrument Transformers: Construction, working and applications
a) CT
b) PT

6. Electronic Instruments: (06 Periods)

6.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO and its various controls. Applications of CRO.
6.2 Digital multi -meter (only block diagram) and Applications

7. LCR meters. (04 Periods)

Study of LCR meters and their applications

8. Power Measurements in 3-phase circuits by (04 Periods)

8.1 Two wattmeter method in balanced and unbalanced circuits and simple problems
8.2 Three wattmeter method

9. Transducers (10 Periods)

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Introduction, Types of Transducers (1 phase,3 phase)

Basic c oncept of pressure measurement, flow measurement, level measurement, displacement measurement using transducers

10. Measurement of Temperature (09 Periods)

Different types of thermometers, thermocouple, resistance temperature detector and their con struction, principle and working. Thermal Imager Camera (Concept)

11. Smart Metering System (06 Periods)

AMI (Advance Metering Infrastructure), Functions of AMI, cyber Security, Advantages
Smart Meter Technology: AMR (Automatic Metering Reading), inverse/reverse metering system in solar power plant, MRI (Meter Reading Instrument)

LIST OF PRACTICALS

1. Use of analog and digital multimeter for measurement of voltage, current (A.C/D.C) and resistance
2. Measurement of pressure by using LVDT
3. To measure th e value of earth resistance using earth tester.
4. To measure power, power factor in a single -phase circuit, using wattmeter and power factor meter and to verify results with calculations.
5. Measurement of power and power factor of a three -phase balanced load b y two wattmeter method.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.
7. Measurement of power in a 3 phase circuit using CT, PT and 3 -phase wattmeter.
8. Use of LCR meter for measuring inductance, capacita nce and resistance.
9. To record all electrical quantities from the meters installed in the institution premises.
10. To measure Energy at different Loads using Single Phase Digital Energy meter
11. Measurement of temperature by using thermister/Thermal Imager
12. Calib ration of single phase and three -phase energy meter and digital energy meter

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INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

1. Electrical Measurements and Measuring Instruments by Golding and Widdis; Wheeler Publishing House, New Delhi
2. Electrical Measurements and Measuring Instruments by SK Sahdev, Uneek International Publications, Jalandhar
3. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
4. Electric Instruments by D. Cooper
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
6. Electronics Instrumentation by Umesh Sinha, Satya Publication, New Delhi
7. Basic Electrical Measurements by Melville B. Staut.
8. Electrical Measurement and Measuring Instruments by JB Gupta, SK Kataria and Sons, New Delhi
9. Electrical Measurement and Measuring Instruments by ML Anand, SK Kataria and Sons, New Delhi
10. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

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Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	05	06
2	06	08
3	06	08
4	10	12
5	18	20
6	06	08
7	04	04
8	04	04
9	10	12
10	09	10
11	06	08
Total	**84**	**100**

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3.3 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

L	T	P
6	-	-

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 materialswill be needed in order to execute the above mentioned functions. He may also to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

LEARNING OUTCOMES

After undergoingthe subject, students will be able to:

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

DETAILED CONTENTS

1. Classification (10 Periods)

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

2. Conducting Materials (12 Periods)

   2.1 Introduction
   2.2 Resistance and factors affecting it such as alloying and temperatu
   2.3 Classificationof conducting material as low resistivity and high resistivity materials, low resistance materials
   2.3.1 Copper:
   General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering.

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

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

2.3.4 Introduction to bundle conductors and its applications.

2.3.5 Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same

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

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

2.6 Superconductors and their applications

3. Review of Semi-conducting Materials (12 Periods)

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

4. Insulating materials; General Properties: (10 Periods)

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

4.2 Physical Properties:
Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness

4.3 Thermal Properties:
Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics

4.4 Chemical Properties:
Solubility, chemical resistance, weatherability

4.5 Mechanical properties, mechanical structure, tensile structure

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5. Insulating Materials and their applications: (10 Periods)

5.1 Plastics

5.1.1 Definition and classification

5.1.2 Thermosetting materials:
Phenol -formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine -formaldehyde), epoxy resins - their important properties and applications

5.1.3 Thermo -plastic materials:
Polyvinyl chloride (PVC), polyethylene, silicones, their important properties and applications

5.2 Natural insulating materials, properties and their applications

- Mica and Mica products
- Asbestos and asbestos products
- Ceramic materials (porcelain and steatite)
- Glass and glass products
- Cotton
- Silk
- Jute
- Paper (dry and impregnated)
- Rubber, Bitumen
- Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation
- Enamels for winding wires
- Glass fibre sleeves

5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF -their properties and applications

6. Magnetic Materials: (10 Periods)

6.1 Introduction - ferromagnetic materials, permeability, B -H curve, magnetic saturation, hysteresis loop including coer cive 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 s teel 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

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6.3 Hard magnetic materials

Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications

7. Special Materials (10 Periods)

Thermocouple, bimetals, leads soldering and fuses material and their applications, thermistor, sensistor, varistors and their practical appl ications.

8. Materials for Electrical Machines (10 Periods)

Introduction to various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid -term and end -term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva -voce

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods)	Marks Allocation (%)
1.	10	12
2.	12	14
3.	12	14
4.	10	12
5.	10	12
6.	10	12
7.	10	12
8.	10	12
Total	**84**	**100**

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3.4 DIGITAL PRINCIPLES AND ELECTRONICS

L	T	P
5	-	4

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. Number Systems (08 Periods)

   1.1 Decimal, binary, octal and hexa -decimal number systems and their inter - conversion
   1.2 Binary and Hexadecimal addition, subtraction and multiplication
   1.3 1's and 2's complement methods of addition/subtraction

2. Gates (08 Periods)

   Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and EX-OR exclusive NOR gates

3. Boolean Algebra (10 Periods)

3.1 Boolean Relations and their applications
3.2 DeMorgan's Theorems
3.3 K-Map upto four variables

4. Combinational Circuits (12 Periods)

4.1 Half adder, Full adder
4.2 Encoder, Decoder
4.3 Multiplexer/Demultiplexer
4.4 Display Devices (LED, LCD and 7 -segment display)

5. Flip-Flops (09 Periods)

5.1 J-K Flip-Flop
5.2 R-S Flip-Flop
5.3 D-Type Flip-Flop
5.4 T-Type Flip-Flop
5.5 Applications of Flip-Flops

6. Combinational and sequential circuits (06 Periods)

6.1 Combinational Logic circuits
6.2 Sequential Logic circuits
6.3 Synchronous and Asynchronous circuits

7. Introduction of Shift Registers and Counters (06 Periods)

8. A/D and D/A Converters (06 Periods)

7.1 A/D converter (Counter ramp, successive approximation method of A/D Conversion)

7.2 D/A converters (Binary weighted, R-2R D/A Converter)

9. Semi-conductor Memories (04 Periods)

8.1 Typesof semi-conductor memories: RAM, ROM, EPROM, EEPROM
8.2 Static and dynamic RAM
8.3 Merits, demerits, and applications

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. To verify the truth table for JK flipflop
5. Construction and testing of any counter
6. Verification of operation of a 8-bit D/A Converter

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INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A converters and other Topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini projects based on microprocessor operations may be identified and given to students as assignments.

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alotted (Periods)	Marks Allotted (%)
1.	08	10
2.	08	12
3.	10	14
4.	12	15
5.	09	10
6.	06	11
7.	06	08
8.	06	10
9.	04	10
Total	**70**	**100**

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3.5 ELECTRICAL MACHINES - I

L	T	P
6	-	4

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. Introduction to Electrical Machines (20 Periods)

    1.1 Definition of motor and generator
    1.2 Torque development due to alignment of two fields and the concept of torque angle
    1.3 Electro -magnetically induced emf
    1.4 Elementary concept of an electrica l machine
    1.5 Comparison of generator and motor
    1.6 Generalized theory of electrical machines

2. DC Machines (25 Periods)

    2.1 Main constructional features, Types of armature winding
    2.2 Function of the commutator for motoring and generation action

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2.3 Factors determining induced emf
2.4 Factors determining the electromagnetic torque
2.5 Various types of DC generators
2.6 Significance of back e.m.f., the relation between back emf and Terminal voltage
2.7 Armature Reaction
2.8 Methods to improve commutation
2.9 Performance a nd characteristics of different types of DC motors
2.10 Speed control of dc shunt/series motors
2.11 Need of starter, three point dc shunt motor starter and 4 point starter
2.12 Electric Braking
2.13 Applications of DC motors
2.14 Faults in dc machines and their retrospective
2.15 Lo sses in a DC machine
2.16 Determination of losses by Swinburne's test
2.17 Rating and Specifications of DC machines

3. Single Phase Transformer (25 Periods)

3.1 Introduction
3.2 Constructional features of a transformer and parts of transformer
3.3 Working principle of a tran sformer
3.4 EMF equation
3.5 Transformer on no -load and its phasor diagram
3.6 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
3.7 Mutual and leakage fluxes, leakage reactance
3.8 Transformer on load, voltage drops and its phasor diagram
3.9 Equivalent circuit diagram
3.10 Relation between induced emf and terminal voltage, voltage regulation of a transformer - mathematical relation
3.11 Losses in a transformer
3.12 Open circuit and short circuit test. Calculation of efficiency, condition for maximum efficiency -maintenance of Transformer, scheduled Maintenance
3.13 Auto transformer construction, working and applications
3.14 Different types of transformers including dry type transformer.
3.15 Rating and Specifications of single phase transformer

4. Three Ph ase Transformer (14 Periods)

4.1 Construction of three phase transformers and accessories of transformers such as Conservator, breather, Buchholtz Relay, Tap Changer (off load and on load) (Brief idea)

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4.2 Types of three phase transformer i.e. delta -delta, delta-star, star -delta and star - star

4.3 Star delta connections (relationship between phase and line voltage, phase and line current)

4.4 Conditions for parallel operation (only conditions are to be studied)

4.5 On load tap changer

4.6 Difference between power and distrib ution transformer

4.7 Cooling of transformer

4.8 Rating and Specifications of three phase transformers

LIST OF PRACTICALS

1. To measure the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase -winding in sequence
   OR
   Measurement of the angular displacement of the rotor of a slip -ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of ro tor winding
2. Speed control of DC shunt motor (i) Armature control method (ii) Field control method
3. Study of DC series motor with starter (to operate the motor on no load for a moment)
4. Determine efficiency of DC motor by Swinburne's Test at (i) rate d capacity (ii) half full load
5. To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load
6. To find the efficiency and regulation of single phase transformer by actually loading it.
7. Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations
8. Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions such as
   (a) Star -star
   (b) Star -delta
   (c) Delta -star
   (d) Delta - Delta configuring conditions.

INSTRUCTIONAL STRATEGY

Electrical machines being a core subject of electrical diploma curriculum, where a student will deal with various types of electrical machines which are employed in industry, 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. Special care has to be taken on conceptual understanding of concepts and principles in the subject. For this purpose exposure to industry, work place s, and utilization of various types of electrical machine for different applications may be emphasized. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specificati ons.

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MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid -term and end -term written tests
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	20	10
2.	25	35
3.	25	35
4.	14	20
Total	**84**	**100**

3.6 ENVIRONMENTAL STUDIES

L	T	P
3	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Introduction (04 Periods)

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

2. Air Pollution (04 Periods)

   2.1 Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (08 Periods)

   3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O_2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (06 Periods

   4.1 Sources of soil pollution
   4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
   4.3 Effect of Solid waste
   4.4 Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (06 Periods)

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Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable n oise level, Different method of minimize noise pollution.

6. Environmental Legislation (08 Periods)

Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Envir onmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)

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

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the eff ect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	**42**	**100**

41 COMMUNICATION SKILLS

L	T	P
4	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTE

1. Functional Grammar (16 periods)
   - 1.1 Prepositions
   - 1.2 Framing Questions
   - 1.3 Conjunctions
   - 1.4 Tenses

2 Reading (16 periods)

- 2.1 Unseen Passage for Comprehension, Vocabulary enhancement (Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic.

3 Writing S (24 perio

- 3.1 Correspondence
  - a) Business Letters – Floating Quotations, Placing Orders, Complaint Letters.
  - b) Official Letters – Letters to Government and other Offices
- 3.2 Memos, Circular, Office Orders
- 3.3 Agenda & Minutes of Meeting
- 3.4 Report Writing

LIST OF PRACTICALS

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Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.
Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Speaking and Listening Skills

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

INSTRUCTION AL STRATEGY

Students should be encouraged to participate in role play and other student -centered activities in class rooms and actively participate in listening exercises

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book -I by RevathiSrinivas; Abhishe k Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e -tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

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

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28
2	16	28
3	24	44
Total	**56**	**100**

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4.2 INDUSTRIAL ELECTRONICS AND CONTROL

L	T	P
	5	14

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 methods. The old magnetic and electrical control schemes have all become obsolete. Electrical Engineering diploma holder, many times, has to maintain the panels used in the modern control process. Therefore, the knowledge components like thyristors and other semiconductor devices used in such control panels is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance of this subject, it has been incorporated in the curriculum.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. Introduction to SCR (18 Periods)

1.1 Power diode characteristics, application of general purpose diode, fast recovery diode and Schottkey diode, use in R, RL series circuit.

1.2 Construction and working principles of an SCR, two transistor analogy and characteristics of SCR

1.3 SCR specifications and rating

1.4 Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac

1.5 Basic idea about the selection of heat sinks for SCR and TRIACS

1.6 Methods of triggering a Thyristor. Study of triggering circuits

1.7 UJT, its Construction, working principles and V -I characteristics, UJT relaxation oscillator

1.8 Commutation of Thyristors

1.9 Seriesand parallel operation of Thyristors

1.10 Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc.

1.11 dv/dt and di/dt protection of SCR.

2. Controlled Rectifiers (12 Periods)

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2.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of freewheeling diode.
2.2 Single phase half controlled full wave rectifier
2.3 Single phase fully controlled full wave rectifier
2.4 Single phase full wave centre tapped rectifier
2.5 Three phase full wave half controlled bridge rectifier
2.6 Three phase full wave fully controlled bridge rectifier

3. Inverters, Choppers, Dual Converters and Cyclo Convertors (24 Periods)

3.1 Inverter -introduction, working principles, voltage and current driven series and parallel inverters and applications
3.2 Choppers -introduction, types of choppers and their working principles and applications
3.3 Dual converters -introduction, working principles and applications
3.4 Cyclo -converters - introduction, types, working principles and applications

4. Thyristor Control of Electric Drives (18 Periods)

4.1 DC drives control (Basic Concept)
4.2 Half wave drives
4.3 Full wave drives
4.4 Chopper drives
4.5 AC drives control
4.6 Phase control
4.7 Variable frequency a.c. drives
4.8 Constant V/F application
4.9 Voltage controlled inverter drives
4.10 Constant current inverter drives
4.11 Cyclo convertors controlled AC drives
4.12 Slip control AC drives

5 Uninterrupted power supplies (12 Periods)

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

LIST OF PRACTICALS

1. To draw V -I characteristics of an SCR
2. To draw V -I characteristics of a TRIAC
3. To draw V -I characteristics of a DIAC
4. To draw uni -junction transistor characteristics
5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC Quadriac (fabrication of this circuit)
8. Speed -control of a DC shunt motor or universal motor
9. To observe the output wav e shape on CRO of
   (a) Single phase half controlled full wave rectifier
   (b)Single phase controlled rectifier

INSTRUCTIONAL STRATEGY

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The teachers may encourage students to perform practical simultaneously for better understanding of the subjects and verification of theoretical concepts. The various components must be shown to the students for identification and also tested. Practical applications of the various circuits and devices should be discussed in the class. The available video films on the subject must be shown to the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests.
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

BOOKS RECOMMENDED

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	18	20
2.	12	15
3.	24	25
4.	18	20
5.	12	20
Total	**84**	**100**

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4.3 ELECTRICAL DESIGN, DRAWING AND ESTIMATING - I

L	T	P
3	-	8

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS (To make 16 Sheets)

1. Symbols and Signs Conventions (2 Sheets)

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

2. Wiring Diagram

   2.1. Wiring diagram of light, f an, bell and alarm circuits. (6 Sheets)
   2.2. Staircase and godown wiring
   2.3 Traffic light signal control circuit at crossroads

3. Panels/Distribution Boards (6 Sheets)

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

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4. Orthographic projections of Simple Electrical Parts (8 Sheets)

- Bus bar post/ Kit Kat
- Pin type and shackle type insulator (Pin Type 11kV/66kV)
- Bobbins of a small transformer / choke
- Stay insulators/Suspension type insulators
- Rotor of a squirrel cage induction motor
- Motor body (induction motor) as per IS Specifications (using outside dimensions)
- Slip rings of 3 -phase induction Motor.
- Stator of 3 phase Induction motor (Sectional View)

5. Prepare atleast 2 wiring diagram and block diagrams for circuits/systems using any Engineering Graphic package (preferably CAD) (4 Sheets)

6. Introduction to Estimating & Costing (04 periods)

Purpose of estimating and costing, proforma for making estimates, preparation of materials schedule, costing, price list, preparation of tender document (with 2 -3 exercises), net rice list, market survey, overhead charges, labour charges, electrical point m ethod and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills.

7. Types of Wiring (04 periods)

Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire -gauge and tables (to be prepared/arranged)

8. Estimating and Costing (18 periods)

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

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

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

9. Estimating Materials Required (12 Periods)

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

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

9.3Single line diagram, layout sketching of outdoor, indoor 11kV sub -station or 33kV sub-station

10. Preparation of Tender Documents (04 Periods)

Tender – constituents, finalization, specimen tender.

Procedure to take financial loans from banks for taking contracts.

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.

MEANS OF ASSESS MENT

- Assignments and quiz/class tests
- Mid -term and end -term written tests
- Sketching
- Design and Drawing
- Workshop Job
- Model prototype making

LIST OF PRACTICALS

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

RECOMMENDED BOOKS

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

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

Websites for Reference:

http://swayam.gov.in

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4.4 CONTROL SYSTEM & PROCESS APPLICATION

L	T	P
5	-	-

Rationale:

Control system has pronounced impact on the industrial processes almost all sophisticated automatic controls. A diploma holder with specialization in "Industrial Electronics and Control" has to bear the responsibilities of operation and maintenance of these plants and equipment's in industry. Therefore the contents of this course have been selected on the basis of demand of modern industries. This subject deals with various control system devices and components, performance of control systems and various controllers used for improving the performance.

LEARNING OUTCOMES

After undergoing the subject, st udent will be able to:

- Understand the basics of components and devices used in control system.
- Explain the input output relationship of simple control system components.
- Explain the performance of control system using various mathematical tools.
- Understan d various automatic control actions used in control system.
- Know the basic knowledge of electronic, pneumatic& hydraulic controllers.
- Understand the discrete control system.

Detailed Contents

1. **Introduction:** **(05 Periods)**

Need of automatic control, Concept of open loop and closed loop control, Block diagram of feedback control system and its basic elements, definition and explanation of following control system.

(i) Linear and Non -Linear Systems.
(ii) Continuous and discrete Systems.
(iii) Static and Dynamic Systems.
(iv) Single Input Single Output (SISO) System and Multiinput Multioutput (MIMO) System.

Process and Process characteristics, Analogy with electrical system, Concept of process time delay.

2. **Components & Devices Used In Control System:** **(10 Periods)**

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Brief description and working of potentiometer, self balancing potentiometer, differential transformer, synchro's, servom otors, tac hogenerators, S teeper motors and DC Tacho Generator.

3. **Input Output Relationship of System & Control system Components: (08 Periods)**

(i) Concept of transfer function and its use in control system.
(ii) Derivation of transfer function of following systems and components.
(a) Simple RC low pass network.
(b) First order thermal system and fluid level system.
(c) General Feedback Control System.

4. **Performance of Control System: (17 Periods)**

(i) Step, Ramp, Pulse and sinusoidal type of inputs and their Laplace Transforms.

(ii) Time domain response of First order an d Second order system with step input.

(iii)Definitions of Rise time, Peak overshoot, Settling time, Natural frequency and Damping Ratio pertaining to second order system.

(iv) Initial value and final value theorems and their use in control systems.

(v) Types of feedback systems and error constants.

(vi) Bode Plot

(vii) Nyquist Plot

(viii) Stability of system , Gain margin and phase margin

5. **Automatic Control Actions: (9 Periods)**

Control actions, Types of control actions, Two position control (On/Off action), Proportional, Proportional plus integral, Propor tional plus derivative, Prop ortional plus integral plus derivative action.

6. **Controllers In Process Control: (12 Periods)**

i. Electronic Controller:
On-OFF controller, Proportional, Proportional plus integral, Prop ortional plus integral
plus derivative.

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ii. **Hydraulic & Pneumatic Controllers:**
Principle and working of hydraulic controllers (Proportional and Proportional integral), Pneumatic P -I-D controller comparison of electronic, Hydraulic and Pne umatic controllers.

7. **Discrete Data System: (9 Periods)**

Discrete signal system, Discrete line system, Block diagram explanation of digital data system, Representation of microprocessor controlled system, as a digital data system, Concept of sampling, Analog to digital converter, Sample and hold circuit, concept of de - sampling, Digital to analog converter.

INSTRUCTIONAL STRATEGY

Since this is a descriptive subject, it is suggested that visits to different types industries / stations and substations including grid stations be arranged and various equipment, accessories and components explained to the students before the actual class room teaching and make them familiar with to bear the responsibilities of operatio n and maintenance of these plants and equipment's in industry . There should be at least 1 visits during the semester. The students may be asked to prepare notes while on visit and submit the report and give seminar. In addition, viva -voce be conducted t o evaluate the knowledge gained during the field visit.

MEANS OF ASSESSMENT

– Assignments and quiz/class tests, mid -term and end -term written tests, model/prototype making
– Actual laboratory and practical work / model/prototype making, assembly and disassembl y exercises and viva - voce

RECOMMENDED BOOKS

- Control system components -M.D.Desai
- Control systems -A.Anand Kumar
- Control system Engineering – S.K.Bhattacharya (PEARSON)
- Process Control Systems – F.G.Shinskey
- Process Control Principles And Applications – Surekha Bhanot
- Process Control – K.Krishnaswamy
- e-books/e -tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:
http://swayam.gov.in
https://nptel.ac.in

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	07
2	10	15
3	08	12
4	17	25
5	09	12
6	12	17
7	09	12
Total	**84**	**100**

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4.5 TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

L	T	P
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RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. Transmission Systems (28 Periods)

   1.1 Layout of transmission system, selection of voltage for H.T and L.T lines, advantages of high voltage for Transmission both AC and DC

   1.2 Comparison of different system: AC versus DC for power transmission, conductor material and sizes from standard tables

   1.3 Constructional features of transmission lines: Types of supports, types of insulators, Types of conductors, Selection of insulators, conductors, earth wire and their accessories, Transposition of conductors and string efficiency of suspension type insulators, Bundle Conductors.

   1.4 Mechanical features of line: Importance of sag, calculation of sag, effects of wind and ice related problems; Indian electricity rules pertaining to clea

   1.5 Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission line, voltage regulation, and concept of corona. Effects of corona and remedial measures

   1.6 Transmission Losses

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

2. Distribution System (21 Periods)

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2.1 Lay out of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC radial distribution system, determination of size of conductor

2.2 Preparation of estimates of HT and LT lines (OH and Cables).

2.3 Cons tructional features of LT (400 V), HT (II kV) underground cables, advantages and disadvantages of underground system with respect to overhead system.

2.4 Losses in distribution system

2.5 Faults in underground cables -determine fault location by Blavier Test, Mur ray Loop Test, Varley Loop Test

3. Substations: (21 Periods)

3.1 Brief idea about substations; out door grid sub -station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation

3.2 Layout of 33/11 KV & 220/33KV distribution substation and various auxiliaries and equipment associated with it.

4. Power Factor: (14 Periods)

4.1 Concept of power factor

4.2 Reasons and disadvantages of low power factor

4.3 Methods for improvement of po wer factor using capacitor banks, Static VAR Compensator (SVC)

5. Revenue and Energy loss (14 Periods)

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

Note: Students should visit power generation plants, sub -stations etc.

INSTRUCTIONAL STRATEGY

Since this is a descriptive and practice oriented subject, it is suggested that visits to different types of power generating stations and substations including grid stations be arranged and various equipment, accessories and components explained to the students befo re the actual class room teaching and make them familiar with the equipment and accessories installed over there. There should be at least 3 visits during the semester. The students may be asked to prepare notes while on visit and submit the report and g ive seminar. In addition, viva -voce be conducted to evaluate the knowledge gained during the field visit.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid -term and end -term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva -voce

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RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	28	30%
2	21	20%
3	21	20%
4	14	15%
5	14	15%
Total	**98**	**100**

4.6 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Basics of Energy

   1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
   1.2 Global fuel reserve
   1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
   1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

   2.1 Introduction to energy management, energy conservation, energy efficiency and its need
   2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
   2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating

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3. Electrical Supply System and Motors

3.1 Types of electrical supply system
3.2 Single line diagram
3.3 Losses in electrical power distribution system
3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
3.6 Electric Motors

Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors

4. Energy Efficiency in Electrical Utilities

4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
4.2 Compressed Air System: Types of air compressor and its applications, Leakage, Energy saving opportunities in compressors.
4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5. Lighting and DG Systems

5.1 Lighting Systems: Basic definitions, Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation

6. Energy Efficiency in Thermal Utilities

6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (TOE)
6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
6.4 Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features
7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

8. Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery
8.2 Concept and types of co-generation system

9. General Energy Saving Tips
Energy saving tips in:

9.1 Lighting
9.2 Room Air Conditioner
9.3 Refrigerator
9.4 Water Heater
9.5 Computer
9.6 Fan, Heater, Blower and Washing Machine
9.7 Colour Television
9.8 Water Pump
9.9 Cooking
9.10 Transport

10. Energy Audit

10.1 Types and methodology
10.2 Energy audit instruments
10.3 Energy auditing reporting format

PRACTICAL EXERCISES

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

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015

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

Important Links:

(i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in
(ii) Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in
(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.
(iv) **Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in
(v) Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.
(vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in

4.7 Universal Human Values

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Course Objectives

This introductory course input is intended

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

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

Course Methodology

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

The syllabus for the lectures is given below:

- After every two lectures of one hour each, there is one hour practice session.
- The assessment for this subject is as follows:
- Sessions Marks (Internal): 20
- Practical Marks (External): 30
- Total Marks: 50

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

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration – what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

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6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being a s a co -existence of the sentient 'I' and the material the Body'
2. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and ac tivities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya* ; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society - Harmony in Human - Human Relationship

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human -human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay -tripti* ;
   a. Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
3. Understanding the meaning of *Vishwas* ; Difference between intention and competence
4. Understanding the meaning of *Samman* , Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samrid hi, Abhay, Sah -astitva* as comprehensive Human Goals
6. Visualizing a universal harmonious order in society - Undivided Society (*AkhandSamaj),* Universal Order (*SarvabhaumVyawastha)* - from family to world family!

-Practice Exercises and Case Studies will be take n up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co - existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature -recyclability and sel f-regulation in nature
3. Understanding Existence as Co -existence (*Sah -astitva*) of mutually interacting units in all -pervasive space
4. Holistic perception of harmony at all levels of existence

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
   a) Ability to utilize the professional competence for augmenting universal human order
   b) Ability to identify the scope and characteristics of people -friendly and eco -friendly production systems,

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c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

7. To inculcate Human Values among Students:The Role of self ,Parents and Teachers -Practice Exercises and Case Studies will be taken up in Practice Sessions.

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

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

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics , Excel books, New Delhi.

b. The teacher's manual (Latest Edition)

R.R Gaur, R Asthana , G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

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

1. B L Bajpai, 2004, *Indian Ethos and Modern Management* , New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism* , Commonwealth Purblishers.
3. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ekParichay,* Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if peoplemattered* , Blond & Briggs, Brita in.
9. A.N. Tripathy, 2003, *Human Values* , New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in , http://www.aktu.ac.in
2. Story of Stuff, *http://www.storyofstuff.com*

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3. Al Gore, *An Inconvenient Truth* , Paramount Classics, USA
4. Charlie Chaplin, *Modern Times* , United Artists, USA
5. IIT Delhi, *Modern Technology –the Untold Story*
6. Case study Hevade Bazar Movie
7. RC Shekhar , Ethical Contradi ction ,Trident New Delhi
8. *Gandhi A., Right Here Right Now, Cyclewala Production*

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
Total	**42**	**100**

INDUSTRIAL TRAINING

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

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

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

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

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

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

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

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5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. Introduction (04 Periods)

    1.1 Concept /Meaning and its need
    1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship

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1.3 Sole proprietorship and partnership forms and other forms of business organisations

1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organisation: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrep reneur Parks

2. Market Survey and Opportunity Identification/Ideation (04 Periods)

2.1 Scanning of the business environment

2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities

2.3 Types and conduct of market survey

2.4 Assessment of demand and supply in potential areas of growth

2.5 Identifying business opportunity

2.6 Considerations in product selection

2.7 Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)

3.1 Preliminar y project report

3.2 Detailed project report including technical, economic and market feasibility

3.3 Common errors in project report preparations

3.4 Exercises on preparation of project report

3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

4.1 Definitions and importance of management

4.2 Functions of management: Importance and process of planning, organising, staffing, directing and controlling

4.3 Principles of management (Henri Fayol, F.W. Taylor)

4.4 Concept and structure of an organisation

4.5 Types of industrial organisations and their advantages

4.6 Line organisation, staff organisation

4.7 Line and staff organisation

4.8 Functional Organisation

5. Leadership and Motivation (08 Periods)

5.1 Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders

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5.2 Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivatio n (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)

6.1 Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods

6.2 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ

6.3 Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion

6.4 Financial Managemen t: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)

7.1 Introduction and importance of Healthy Work Culture in organization

7.2 Components of Culture

7.3 Importance of attitude, values and behavior

7.4 Behavioural Science – Individual and group behavior.

7.5 Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

8.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company

8.2 Objectives of Financial Management: Profit Maximization v/s Wealth Maximization

9. Miscellaneous Topics (10 Periods)

9.1 To tal Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)

9.2 Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONA L STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

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MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid -term and end -term written tests
- Model/Prototype making.

RECOMMENDED BOOKS

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

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	**70**	**100**

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5.2 SWITCHGEAR AND PROTECTION

L	T	P
5	1	-

RATIONALE

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma passouts have become more complex than what they used to be earlier. He is required to work with modern electrical equipment and maintain reliability of supply.

The course is designed to develop understanding of the principles and working of protective switchgear so that one can handle, install and maintain them and also take decisions at his level in different situations.

This subject teaching requires reinforcement from visits to substations, power stations and well designed labo ratory experiences. A practical orientation to the teaching of this subject is suggested.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. Faults (15 Periods)

   Types of faults, three phase symeterical faults, effects of faults on system reliability and stability, abnorma lities, short circuits and their effects, representation of fault conditions through single line diagrams

2. Switchgear (24 Periods)

   2.1 Purpose of protective gear, characteristics of a protection system.

   2.2 Classification of fuses H.V. Fuses, application and working, grading and co - ordination L.V. fuses, selection of fuses, characteristics

   2.3 Isolators and switches, outdoor isolators, functions, air break switches, braking capacity of swi tches.

   2.4 Circuit breakers : - requirements of circuit breakers, definition of terms associated with circuit -breakers, reasons for arc formation, principles of arc extinction, types of circuit -breakers, comparison with oil circuit breaker, classification, rati ng of circuit breakers, working of different types of air and

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oil circuit breakers, specification of circuit breakers, maintenance schedule, SF - 6 and Vacuum circuit breakers.

2.5 Relays:Requirement of relays, operation principles, induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction too distance relay.

3. Protective Schemes (15 Periods)

3.1 Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults - their reasons, effect and protections used.

3.2 Protection of power transformer: types of faults, its effects, types of proective schemes over current, earth fault, differential protection, Buckho ltz devices, winding temp. protection.

3.3 Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection.

3.4 Protection of feeders: radial, parallel and ring feeders protection, directional time a nd current graded schemes, differential protection.

4. Protection Against Over Voltages (15 Periods)

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

5. Different Type of Sub -stations (15 Periods)

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

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

5.3 Neutralgrounding: - types of grounding solid groundin g, reactance grounding, arc suppression, coil grounding, choice of method of neutral earthing, grounding of sub -stations, grounding of line structure and substation equipment.

5.4 Concept of G.I.S. (Gas Insulated Substation)

RECOMMENDED BOOKS

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

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SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods)	Marks Allocation (%)
1	15	16
2	24	30
3	15	18
4	15	18
5	15	18
Total	**84**	**100**

5.3 PLC, MICRO CONTROLLER & SCADA

L	T	P
6	-	6

RATIONALE

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

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

DETAILED CONTENTS

1. Introduction (24 Periods)

Concept of PLC, building block of PLC, function of various blocks, limitation of relays, advantage of PLC over electromagnetic relays, different programming languages, PLC manufacturer, working of PLC, basic operation and principles of PLC, architectural details.

2. Instruction Set (20 Periods)

2.1 Basic instructions like latch, master control self holding relays, timer instruction like retentive timers, resetting of timers, counter instructions like up counter, resetting of counters.

2.2 LadderDiagram Programming : programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder pro

3. Microcontroller series (MCS-51 over view (20 Periods)

Pin details, I/O ports structure, memory organisation, special function registers instruction set, addressing modes, timers operation, serial port operation, interrupts.

4. Assembly language programming (10 Periods)

Assemblers and Compilers, assembler directives, design and interface.
Examples like: keypad interface, 7 - segment interface, LCD, Stepper motor , A/D, D/A , RTC interface, introduction of PIC microcontrollers.

5. SCADA (10 Periods)

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

LIST OF PRACTICALS

PLCs

1. Components / sub components of aPLC, learning functions of different mo dules of a PLCs
2. Practical steps in programming a PLC (a) using hand held programmer (b) using computer interface.
3. Introduction to step programming language, ladder diagram concepts, instruction list syntax.
4. Basic logic operations, AND, NOT, OR fu nctions
5. Use of PLC for an application
   Car parking, doorbell operation, traffic light control, washing machine, motor in forward and reverse direction
   Microcontrollers
6. Familiarization of micro controllers (8051) kit
7. Testing of general input/ out put on micro controller board
8. Use of micro controller liken in relays, buzzer of working machine, oven

INSTRUCTIONAL STRATEGY

Introduce the subject and make the students familiar with applications of PLCs, micro controller and SCADA. The inputs start with theoretical inputs to architecture, instruction set , assembly language programming, small projects may identified, PLC ladder diagram and programming should be supplemented with visits to industry.

RECOMMENDED BOOKS

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

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocations (%)
1	24	26
2	20	24
3	20	24
4	10	13
5	10	13
Total	**84**	**100**

5.4 ELECTRICAL MACHINES - II

L T P
6 1 6

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 hol der 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 spec ifications

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

1. 3 Phase Induction Motors (25 Periods)

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

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1.12 Starting of 3 -phase induction motors, DOL, star -delta, auto transformer starter.
1.13 Causes of l ow power factor of induction motors
1.14 Testing of 3 -phase motor on no load and blocked rotor test and to find efficiency
1.15 Method of Speed control of induction motor
1.16 Harmonics and its effects, cogging and crawling in Induction Motors.
1.17 Specifications and ratin gs of induction motors.

2. Single Phase Motors (18 Periods)

2.1 Single phase induction motors; Construction characteristics, specifications and applications.
2.2 Nature of field produced in single phase induction motor -double revolving field theory .
2.3 Split phase induction motor
2.3.1 Capacitor start, capacitor run, capacitor start and run motor
2.3.2 Shaded pole motor
2.4 Alternating current series motor and universal motors, construction,working principle and operation, application.
2.5 Single phase synchronous motor
2.5.1 Reluctance motor
2.5.2 Hysteresis motor

3 Synchronous Machines (25 periods)

3.1 Main constructional features of synchronous machine including commutator and brushless excitation system
3.2 Generation of three p hase emf
3.3 Concept of distribution factor and coil span factor and emf equationArmature reaction at unity, lag and lead power factor
3.4 Equivalent circuit diagram of synchronous machine
3.5 Concept of voltage regulation. Determination of voltage regula tion by synchronous impedance method.
3.6 Operation of single synchronous machine independently supplying a load.
3.7 Concept of infinite bus bar. Need and necessary conditions of parallel operation of alternators, synchronizing an alternator (Synchroscope method) with the bus bars
3.8 Operation of synchronous machine as a motor –its starting methods
3.9 Effect of change in excitation of a synchronous motor, V curve, Concept of synchronous condenser.
3.10 Concept and cause of hunting and its prevention
3.11 Specification, rating and cooling of synchronous machines
3.12 Applications of synchronous machines

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4. Special Purpose Machines (16 periods)

Construction, working principl e and application of linear induction motor, stepper motor, AC Servomotor, Submersible Motor,

LIST OF PRACTICALS

1. Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)
2. Determination of effect of rotor resistance on torque speed curve of an induction motor Observe the performance of a ceiling fan (I -ϕ) induction motor) without capacitor
3. Determine the effect of change in capacitor on the performa nce of 1 -phase induction motor and reverse the direction of motor.
4. To plot relationship between no load terminal voltage and excitation current in a synchronous generator at constant speed
5. Determination of the relationship between the voltage and loa d current of an alternator, keeping excitation and speed constant
6. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
7. Determination of the effect of variation of excitation on performance of a syn chronous motor

INSTRUCTIONAL STRATEGY

Teacher should lay -emphasis on development of understanding amongst students about basic principles of operation and control of electrical machines. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions.

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods)	Marks Allocation (%)
1	25	30
2	18	22
3	25	30
4	16	18
Total	**84**	**100**

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5.5 INDUSTRIAL CONTROL

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6 - 4

Rationale

Electric motors are extensively used in all types of industries because of high efficiency and easy control. Most of these motors for precise control use power electronics equipment. An Electrical Engineering diploma holder has to deal with manually operated old machines and automatic controlled modern machines and equipment. To deal successfully with wide spectrum of requirements in the industry, the pass out diploma holders should have adequate knowledge of control components, conventional electromagnetic controllers, conventional and solid sate control of electric machines and electric drives. The study of this subject would certainly build up confidence among the students to face the challenges of industry.

LEARNING OUTCOMES

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

- Apply automatic control modern machine equipment.
- Get adequate knowledge of control components.
- Understand the conventional electromagnetic controllers.
- Use conventional and solid-state components of electric machine and drives
- Understand concepts of various methods of control strategy.

DETAILED CONTENTS

1. **Speed Control of D.C. Motors:** (11 Periods)

(a) Conventional Control:

Methods of Speed control, Armature circuit resistance control, Field control, Motor voltage control (Ward Leonard methods only).

(b) **Solid State Control:**

Half controlled and fully controlled rectifier fed schemes (Single Phase and Three Phase) for D.C. separately excited and Series motors, Soild state ward leonard schemes, Chopper control scheme (Time Ratio Control Only), Block diagram speed feedbacks, Comparison, Current and Speed feedbacks, Comparison of proportional and proportional plus integral control (Simple Numericals Only).

2. **Speed Control of Three Phase Induction Motors:** (19 Periods)

(a) Conventional Control:

Methods of speed control, Variable terminal voltage control, Variable frequency control, Pole changing control, Rotor resistance control, Concept of emf injection in rotor circuit.

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(b)Solid State Control:

Line A.C. voltage contro ller scheme, Voltage source fed scheme, Pulse width modulated fed inverter scheme, Comparison of VSI fed and CSI fed schemes, Cyclo Converter fed scheme, Static rotor resistance scheme, Slip power recovery scheme. Block diagram explanatio n of closed loop control scheme, Applications of various schemes.

3. **Solid State Control of Synchronous Motor:** (12 Periods)

Self commutated inverter fed scheme, Voltage source inverter fed scheme, Block diagram explanation of closed loop scheme.

4. **Solid State Control of FHP AC Motors/DC Motors:** (14 Periods)

D. C. Motor Control:

Half wave and Full wave single thyristor schemes.

A. C. Motor Control:

Triac Control Scheme, Single plase A. C. voltage controller scheme.

5. **Control Components:** (14 Periods)

Relays (General purpose, Over load, Timing), Contactors (Solenoid Type, Clapper Type), uses and combination fuse switch units, Miniature circuit breaker, Push buttons, Limit switches, Phase failure r elay, Selector switch, Master controller and Drum switches.

6. **Electromagnetic Controllers:** (14 Periods)

Symbols for various components, Schematic control diagram, Wire control diagram.

Forward/reverse operation of three phase squirrel cage induction motor, Slip ring induction motor starter plugging of squirrel cage induction motor, dc shunt motor starter, Synchranous motor starter, Starter for capacitor type split phase motor, Reversal of universal motor.

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INDUSTRIAL CONTROL LAB

List of Practicals

1. Speed control of D. C. shunt motor using Armature Voltage Control method (Ward Leonard method of speed control).

2. To plot speed - Torque characteristics of D. C. shunt motor at different firing angles when the motor is fed by a fully controlled/half controlled thyrister rectifier.

3. To plot speed - Torque characteristics of D.C. shunt motor fed by a chopper using time ration control technique only.

4. To plot speed - torque characteristics of Three Phase Squirrel cage induction motor at two different frequency with the help of cycloconverter.

5. Speed control of FHP motor using Solid State A. C. Voltage Controller.

6. Study of Dynamic braking of D. C. shunt/separately excited motor and to see the effect of resistance on braking time of the machine.

7. Study of Plugging method of Induction motor braking and to study the effect of variation of supply voltage on braking time.

8. Study of Y/D autotransformer starting methods of Three Phase induction motor starting.

INSTRUCTIONAL STRATEGY

Teacher should lay emphasis on development of understanding amongst students about basic principles of Industrial control of . This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid term and end term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce

RECOMMENDED BOOKS

1. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.
2. D.C. Motors, speed controls , Servo systems - Sam Stuart
3. Electric Motors and Drives - Austin Hughes and Bill Drury

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Websites for Reference:
http://swayam.gov.in
https://nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	11	14
2	19	22
3	12	14
4	14	17
5	14	17
6	14	16
Total	**84**	**100**

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6.1 INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL EQUIPMENT

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6	-	6

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, instruc tions 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 activ ities. Appropriate field trips will reinforce the learning.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Tools and Accessories (14 Periods)

   Tools, accessories and inst ruments required for installation, maintenance and repair work. Knowledge of Indian Electricity rules, safety codes, causes and prevention of accidents, artificial respiration of an electrocuted person, workmen's safety devices

2. Installation (40 Periods)

   2.1 Installation of tran smission and Distribution Lines
   Erection of steel structures, connecting jumpers, tee -off points, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway line crossings, clearanc es; earthing of transmission lines and guarding, spacing and configuration of conductors: Arrangement for suspension and strain insulators, bird guards, anti -climbing devices and danger plates; sizes of conductor, earthwire and guy wires.
   Laying of servic e lines, earthing, provision of service fuses, installation of energy meters

   2.2 Laying of Underground Cables
   Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths and clearances from other servic es such as: water, sewerage, gas, heating and other mains, and also a series of power and

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telecommunication cables and coordination with these services, excavation of trenches, direct cable laying, including laying of cable from the drum, laying cable in t he trench, taking all measurements and making drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc,) laying of cables into pipes and conduits and within buildings.

2.3 Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolators, voltage and current transformers, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration. Earthing system, fencing of yard, equipment foundations and trenches etc..

2.4 Testing of various electrical equipment such as electrical motor, transformers, cables, and generators, motor control centres, m edium voltage distribution panels, power control centres, motor control centres, lighting arrangement, storage, pre -installation checks, connecting and starting, pre -commissioning checks, drying out

2.5 Testing of Transformers: Typetest, oil testing of tr ansformers

3. Maintenance (30 Periods)

3.1 Types of maintenance, maintenance schedules, procedures

3.2 Maintenance of Transmission and Distribution System

Authorized persons, danger notice, caution notice, permit to work, arranging of sh utdowns personally, temporary earthing, cancellation of permit and restoration of supply.

Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections;

Location of faults using Meg gar, effect of open or loose neutral connections, provision of proper fuses on service lines and their effect on system, causes of dim and flickering lights.

3.3 Maintenance of Distribution Transformers

Transformer maintenance and points to be attended to in respect of various items of equipment

Checking of insulation resistance, transformer oil level and BDV test of oil, measurement of earth resistance

3.4 Maintenance of Grid Substations

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

3.5 Maintenance of Motors

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

3.6 Domestic Installation

Introduction, testing of electrical installation of a building, t esting of insulation resistance to earth, testing of insulation and resistance between conductors, continuity or open circuit test

INSTRUCTIONAL STRATEGY

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This subject needs theoretical and practical inputs. Demonstration at actual site may be arranged for conceptual understanding. The subject teacher should plan in advance about the visits to the actual sites and establish liaison with the appropriate authorities/ persons with the help of HOD and Principal of the institution. The students be taken to ac tual workplace and explain various test procedures.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid -term and end -term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva -voce

LIST OF PRACTICALS

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

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods	Marks Allocation (%)
1	14	18
2	40	50
3	30	32
Tota	**84**	**100**

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6.2 MICROPROCESSORS DEVELOPMENT SYSTEM

L	T	P
6	-	4

Rationale :

Microprocessor has brough a revolution in the electronic field. Miniaturization and reliability are two major factors which have made electronic appliances versatile. Computers, pocket calculators and precision instrumentation could become possible and popular only due to microprocessor. A student uipped with the basic knowledge o different types of microprocesso and their variety of applications willprove useful to the industry and he can also responded to entrepreneurial activities.

LEARNING OUTCOMES

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

- Know about basic Structure of 8085
- Understandvarious input output operating , Interrupts DMA of 8085
- Understand various A/D & D/A Converters, PPI chip
- Explain Microprocessor Based application in Data Acquisition system and Protective relays
- Can measure electrical quantity using Microprocessor
- Understand other Microprocessor and Microcontroller
- Test and Debugging of Microprocessor Based syste

DETAILED CONTENTS

1. INTRODUCTION TO MICROPROCESSOR BASED SYSTEMS: (06 Periods)

1.1 Evolution of Microprocessors
1.2 General applications of Microprocessor
1.3 Programming Microprocessors

2. **STRUCTURE OF 8085 MICROPROCESSOR:** (14 Periods)

2.1 (a) Registers.
(b) Address/Data bus.
(c) Control bus.
(d) Interrupts.
2.2 Time multiplexing of address/data bus.
2.3 Concept o stack.
(a) LIFO structure.
(b) Safe for saving required data.
(c) Role in calling subroutine.

2.4 Timing diagram.
(a) Memory cycles.
(b) Opcode fetch.

(c) Memory read cycle.
(d) Memory write cycle.
(e) I/ O read/write cycle.

3. **I/O OPERATING (8085 MICROPROCESSER):** (14 Periods)

3.1 Programmmed I/O
(a) Using I/O port on IC chips.
(b) Programming the ports on IC chips.
(c) No hand shaking in data transfer.
3.2 Software interrupts.
(a) Restart interrupts.
(b) Vectored interrrupts.
(c) Use of software interrupts.
3.3 Interrupts.
(a) Interrupts levels.
(b) Interrupt circuits.
(c) Interrupt instructions.
(d) Extending interrupt system.
3.4 Serial input/output.
(a) RIM and SIM instructions.
(b) How to transmit parallel data serially out.
3.5 Direct memory access scheme.
(a) Need for DMA.
(b) Application of DMA transfer.
(c) Hardware logic used for DMA.
(d) Brief idea about DMA controller chips.

4. **I/O DEVICES:** (14 Periods)
4.1 Some read/write memory chips.
(a) 8155/8156.
(b) Use of I/O ports on these chips.
(c) Use of Timer.
(d) 2114,2148,2164
4.2 A/D and D/A Converters.
(a) Use A/D and D/A converters
(b) D/A converters using R -2R
(c) Sucessive approximation
(d) Up, Up/down counter type A/D converters
(e) Basic concept of parallel A/D conveters
(f) Microprocessor compatible A/D and D/A converters DACO8, AD 7524, AD 7574.
(g) Sample and Holad chip NE 5537
4.3 Programmable peripheral interface chip.
(a) Structure of 8255.
(b) Programming of 8255.
(c) Select ion of modes and hand shaking modes.
(d) Use of BIT set/reset from of port c.
4.4 Other support chips.
(a) Timer 8253.

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(b) Interrupt controller 8259.
(c) Chip Like 8237 DMA controller

5. **MICROPROCESSOR APPLICATION :** (14 Periods)

5.1 Microprocessor based Data Acquisition system.
- 5.1.1 Analog to Digital converters (0800,0808,0809) interfacing
- 5.1.2 Digital to Analog converters (0800,0808) interfacing
- 5.1.3 Seven segment display FND 500, 503, MAN 72
- 5.1.4 Display of alphanumeric characters.

5.2 Microprocessor based protective relays :
- Over Current
- Impedance
- Directional
- MHO relay

5.3 Measurement of electrical quantities using microprocessor :
- Voltage
- Current
- Frequency
- Phase Angle
- Power Factor
- Reactance
- KVA
- KVAR
- KWH

5.4 Measurement based control of firing circuit of thyristor.
- Temperature
- Strain
- Deflection
- Speed

5.5 Mecroprocessor based control of firing circuit of thyristor.

6. **OTHER MICROPROCESSOR AND MICROCONTROLLER :** (10 Periods)

6.1 Comparison of 8085 with Z_80 and 8088, 68000 in terms of
- Bus structure.
- Architecture.
- Interrupts.
- Speeds.
- Memory Addressing

6.2 Single chip Micro Computer : 8748,8051,8096 and 8044

7. **MICROPROCESSOR SYSTEMS :** (07 Periods)

7.1 Master/Slave distributed systems
7.2 Multiple Master distributed systems
7.3 IEEE 488/GPIB interface

8. **TESTING AND DIBUGGING THE MICROPROCESSOR BASED SYSTEMS :** (06 Periods)

8.1 Tools for hard ware checks.

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8.2 In circuit emulators.
8.3 Common faults and rectification (use of debugger)

List OfPracticals

1. Assembly language programming : - Programming of simple problems.

2. Simple programming problems using 8085,8086 microprocessor. rainer kit to gain competence in the use of
   (a) 8085 Instruction set.
   (b) Support chips or 8085.
   (c) Interfacing ADC/DAC chips IS 8085
   (d) Interfacing of Display Devices (Seven Segments)

INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importa nce in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing). Help may be taken in the form of charts, simulation packages to develop clear concep ts of the subject. Programming exercises other than the given in the list may be given to the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid -term and end -term written tests
- Actual laboratory and practical work, exercises
- Viva -voce

RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and Applications with 8080/8085 by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi
2. Microprocessor and Applications by Badri Ram: Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Microprocessor progr amming & applications.by sudhir Goyal, North Publication.
4. Microprocessor and interfacing by Douglas.V.Hall, McGraw Hill Higher Education, New Delhi.
5. E-books/e -tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	06
2	14	16
3	14	16
4	14	16
5	14	16
6	10	12
7	07	10
8	**06**	**8**
Total	**84**	**100**

6.3 UTILIZATION OF ELECTRICAL ENERGY

L	T	P
5	-	-

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Illumination (14 Periods)

   1.1 Nature of light, visibility spectrum curve of relative sensitivity of Human eye and wave length of light.

   1.2 Definition: Luminous flux, solid angle, intensity, luminous efficiency, space to height ratio, reflection factor, lux, shadow.

   1.3 Different types of lamps, construction and working of incandescent and discharge lamps. Fitting required for filament lamp, mercury vapor, sodium lamp, halogen lamp, CFL, LED lamp.

   1.4 Calculation of number of light points for interior illumination calculation of indoor and outdoor illumination levels at different points.

   1.5 Time switches, street lighting, flood lighting and its characteristics

2. Electric Heating and Welding (18 Periods)

   2.1 Advantages of electrical heating

   2.2 Heating methods

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2.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating app liances, thermostat control circuit

2.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications

2.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace

2.2.4 Dielectric heating, applications in various industrial fields

2.2.5 Infra -red heating and its applications (construction and working of two appliances)

2.2.6. Microwave heating and its applications (construction and working of two appli ances)

2.2.7 Solar Heating

2.3 Calculation of resistance heating elements (simple problems)

2.4 Electric Welding

2.4.1 Advantages of electric welding

2.4.2 Welding methods

2.4.3 Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment

2.4.4 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method and their applications . Power supply requirement. Advantages of using coated electrodes,comparison between AC and DC arc welding, welding control circuits,welding of aluminum and copper

3. Electrolytic Processes (08 Periods)

3.1 Need of electro -deposition

3.2 Laws of electrolysis, process of electro -deposition - clearing, operation, deposition of metals, polishing and buffing

3.3. Equipment and accessories for electroplating

3.4. Factors affecting electro -deposition

3.5. Principle of galvanizing and its applications

3.6 Principles of anodizing and its applications

3.7 Electroplating of non -conducting materials

3.8 Manufacture of chemicals by electrolytic process

4. Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers (08 Periods)

4.1 Pri nciple of air conditioning

4.2 Description of Electrical circuit used in

a) Refrigerator,

b) Air -conditioner, and

c) Water cooler

5. Electric Drives (10 Periods)

5.1 Advantages of electric drives

5.2. Characteristics of different mechanical loads

5.3. Types of motors used as electric drive

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5.4. General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc.
5.5 Examples of selection of mot ors for different types of domestic loads
5.6 Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel.
5.7 Selection of motors for Domestic Appliances

6. Electric Traction (12 Periods)

6.1 Advantages of electric traction
6.2 Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub -urban, and main line and their speed - time curves
6.3 Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector -pentagraph
6.4 Factors affecting scheduled speed
6.5. Electrical block diagram of an electric locomotive with description of vario us equipment and accessories used.
6.6 Types of motors used for electric traction
6.7 Power supply arrangements
6.8 Starting and braking of electric locomotives
6.9 Introduction to EMU and metro railways
6.10 Train Lighting Scheme

Note: Students s hould be taken for visits to nearest electrified railway track and railway station to study the electric traction system. Also visit should be made to show electric illumination in building.

INSTRUCTIONAL STRATEGY

It is desired to give ample practical examples in the class while teaching this subject. Teacher must supplement his/her classroom teaching with aids such as models, charts, and video films from time to time. This subject requires demonstrations and expo sure 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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid -term and end -term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva - voce
- Software installation, operation, development

RECOMMENDED BOOKS

1. Art and Science of Uti lization of Electrical Energy by H Partap ,Dhanpat Rai & Sons, Delhi
2. Uti lization of Electrical Energy by JB Gupta ,Kataria Publications, Ludhiana
3. Uti lization of Electrical Energy by Sahdev ,Uneek Publication, Jalandhar
4. A Text Book. of Ele ctrical Power by Dr. SL Uppal, Khanna Publications, Delhi
5. Modern Electric Traction by H Partap ,Dhanpat Rai & Sons, Delhi

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6. Utilization of Electrical Energy by D.R. Arora , North Publication, Jalandhar
7. Generation, Distribution and Utilization if Electrical Pow er by CL Wadhwa ,Wiley Eastern Ltd., New Delhi
8. e-books/e -tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	14	20
2	18	24
3	08	12
4	08	12
5	10	14
6	12	18
Total	**70**	**100**

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6.4 APPLICATIONS OF COMPUTER SOFTWARE IN ELECTRICAL ENGINEERING

L	T	P
-	-	2

RATIONALE

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

LEARNING OUTCOMES

At the end of this course, the students will be able to :

- Use various symbols and notations in electrical and electronics engineering drawings.
- Interpret drawings and draw interferences.
- Draw various electrical and electronics circuits using CAD software.
- Simulate simple electrical and electronics circuits using simulation software

LIST OFPRACTICALS

1. Design different types of followingrectifier circuits using MATLAB/Simulink/Open Source Software and take print out
   (a)Single phase half wave
   (b)Single phase full wave
2. Simulate three resistances in series circuit and find out voltage and current in each resistance .
3. Simulate the following circuits and find out voltage and current in each resistance
   (a)Two resistances in parallel
   (b)Resistance and inductor in parallel
4. Simulate R-L series circuit and observe voltage wave forms across each component.
5. Simulate R-C series circuit and observe voltage wave forms across each component.
6. Simulate R-L-C series circuit and observe voltage wave forms across each component.
7. Simulate R-L-C parallel circuit and observe current wave forms across each component.
8. Simulate star connection using resistors and observe voltage current relation of line and phase
9. Simulate delta connection using resistors and observe voltage current relation of line and phase.
10. Simulate single phase half wave rectifier circuit.
11. Simulate single phase full wave rectifier circuit.
12. Simulate single phase bridge rectifier circuit.

LIST OF RECOMMENDED BOOKS

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

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6.5 PROJECT WORK

L	T	P
-	-	12

RATIONALE

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

LEARNING OUTCOMES

After undergoing the project work, students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be pre

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experie

is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8 -10 rele vant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the cur ricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5 -6 students.

Some of the project activities are given below:

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

A suggestive list of project is given below: -

1. Design and fabrication of control panel for various applications in the field of electrical engineering.
2. Rewinding of a single phase/three phase induction motor
3. Fabrication of working model of a solar thermal power plant.
4. Design and fabrication of automated car parking system.
5. Design and fabrication of automated gate control of railway crossing.
6. Design and fabrication of electrical resistive/inductive/capacitive loads.
7. Design and fabrication of remote control of various domestic electrical appliances.
8. Design and fabrication of microcontroller based DC drive system.
9. Design and fabrication of automatic water level control system.
10. Design and fabrication of automatic solar battery charger.
11. Fabrication of au tomatic star -delta starter.
12. Fabrication of working model of hydro electric power plant.
13. Fabrication of sine wave inverter up to 500VA.
14. Fabrication of water level indicator.
15. Fabrication of rain/fire/ smoke/burglar detector.
16. Fabrication of automatic solar pa nel based street lights.
17. Fabrication of automatic solar panel based traffic lights
18. Fabrication of automatic voltage stabilizer up to 1 KVA.
19. Fabrication of working model of wind power plant.
20. Fabrication of heat convector blower with humidifier.
21. Fabrication of oil based radiation type room heater.
22. Fabrication of small 1 - phase transformer up to 1KVA.
23. Fabrication of UPS up to 500VA.
24. Fabrication of a distribution board as per requirement.
25. Fabrication of Direct -On -Line (DOL) starter.
26. Fabrication of solar tracking system.

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

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

A suggestive criterion for assessing student performance by the external (person 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**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not eligible to receive diploma". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

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 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

3. The external examiner, preferably, a person from industry/organization, who has been associated with the pro ject -oriented professional training of the students, should evaluate the students performance as per the above criteria.

4. 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 nearby industries are approached for instituting such awards.

The teachers are free to evolve other 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

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Equipment requirement:

Following Laboratories are required for Di ploma Programme in Electrical Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Electrical Engineering Laboratory
- Basics of IT/Computer Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Electrical Shop
- Welding Shop
- Fitting and Plumbing Shop
- Sheet Metal Shop
- Mason Shop
- Machine Shop
- Measurement and Instrumentation Laboratory
- Electrical Machines Laboratory
- Installation, Maintenance & Repair Laboratory
- Digital Electronics and Microprocessors Laboratory
- Industrial Control Lab

EQUIPMENT REQUIRED FOR CIVIL ENGINEERING

Sr. No.	Description	Qty	Total Price (Rs)
COMMUNICATION LABORATORY			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500
APPLIED PHYSICS LABORATORY			
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil weston -type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000

Sr. No.	Description	Qty	Total Price (Rs)
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000

23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fi Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall typ	2	20,000
25.	Stoke's Apparatu	2	10,000
26.	Gumther's Apparatu	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning for	2	14,000
28.	Sodium Lamp setup with Bipris	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridg	2	8,000
31.	PN Junction diode Apparat	2	10,000
32.	Laser (as per requiremen	1	1,00,000
33.	Numerical aperture setu	1	25,000
34.	Miscellaneou	LS	3,000
APPLIED CHEMISTRY LABORATO			
	Digital Balanc	1	80,000
	Burette 50m	30	3,000
	Pipette 25m	60	4,000
	Beakers 100m	60	4,000
	Burette stanc	30	30,000
	Glazed til	30	1,000
	Conical flask 50ml (Titration fla	60	4,000
	Standard (Measuring) flask (to prepare standard solut 250ml/100ml	30	6,000
	Able's Flash Point apparat	2	10,000
	(1/10)°C thermomet	06	6,000

Sr. No.	Description	Qty	Total Price (Rs)
	Candles	20	100
	Crucible with li	06	2,000
	Muffle furnac	1	18,000
	Decicator	06	8,000
	Pair of tongue (small and bi	24 (small) 2 (big)	2,000

	Chemicals EDTA-1 kg Eriochrome Black T (solochrome black T)-200g Buffer solution (NH_3 - 2.5 ltr, NH_4Cl – 1 kg) Zinc sulphate-500g H_2SO_4 - 2.5 ltr Phenolphthalein indicator (as per requirement) Methyl orange indicator (as per requirement) Charcoal (as per requirement) Kerosene-1 ltr	LS	20,000
	Miscellaneou	LS	2,000
ENGINEERING DRAWIN			
1.	Drawing Boards (700 x 500m	60	25,00(
2.	Draughtsman Tabl	60	1,80,00(
3.	Draughtsman Stoo	60	40,00(
4.	Computer Aided Drawing (CAD) Softw	30 Use	5,00,00(
5.	Model of different wooder joi	1	1,00(
6.	Model of different screw threa	1	1,00(
7.	Model of various locking devi	1	1,00(
8.	Model of various join	1	1,00(
9.	Cut section Model ovarious coupling	1	3,00(
10.	Miscellaneou	LS	5,00(
ELECTRICAL ENGINEERING LABORTO			
1.	Voltmete	5	7,50(
2.	Ammete	5	10,00(
3.	CR	1	15,00(
4.	Wattmete	5	10,00(
5.	Multimete	1	4,00(
Sr. No.	Descriptio	Qty	Total Pric (Rs)
6.	Resistive loa	1	4,00(
7.	Regulated suppl	1	8,00(
8.	Signal generat	1	5,00(
9.	Rheosta	2	2,50(
10.	Lead acid batter	1	4,00(
11.	Cables, Coils, Lamp (as per requireme	LS	1,50(
12.	Resistance, Inductor, Capacitor (as per requireme	LS	1,50(
13.	Miscellaneou	LS	1,50(
BASICS OF IT LABORATORY/COMPUTER LABORAT			
	Computer System with latest configurat	30	8,00,00(
	Printer (MFP	1	25,00(
	Printer (Lase	1	35,00(
	Plotte	1	75,00(
	Digitise	1	50,00(
	Antivirus Softwa	LS	10,00(
	Internet Facility on Compute	LS	2,00,00(

	LCD Projectc	1	35,00(
	UPS	60	1,20,00(
	Software (latest windows, latest MS Offi	1	1,00,00(
	Scanne	1	10,00(
	Auto CAI	L.S.	
	Auto Civi	L.S.	
	STAAD Pr	L.S.	
	Primavera/MS Proje	L.S.	
	Revi	L.S.	
	BIM	L.S.	
	Miscellaneou	LS	5,00(
CARPENTRY SHO			
1	Work benches fitted with carpenter vi	5	20,00(
2.	Circular saw grind	1	6,00(
3.	Wood cutting band sa-vertica	1	10,00(
4.	Bench grinde	1	5,00(
5.	Drillingmachin	1	8,00(
6.	Wood turning lat	1	40,00(
7.	Wood Planne	1	20,00(
8.	Tool accessories measuring and marking Instrum	25	25,00(
9.	Band saw blade brazing u	1	10,00(
10.	Miscellaneou	LS	1,50(
Sr. No.	Descriptio	Qty	Total Pric (Rs)
PAINTING AND POLISHING SH			
1.	Spray gun with hose pi	1	1,00(
2.	Paint brushe	20	2,00(
3.	Paint/Varnis	LS	2,00(
4.	Air Compressor with 2 hp mo	1 se	10,00(
5.	Miscellaneou	LS	2,00(
ELECTRICAL SHO			
	Tool kit (Plier, Srew driver, Knife, Steel rule, hammer, sc pincer steel tape etc.)	20	20,00(
	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cl Clamps, Test lamp, Tester.(as per requirement)		8,00(
	Electric Iro	1	1,50(
	Electrickettl	1	1,50(
	Ceiling fan/table fa	1	2,50(
	Desert coole	1	5,00(
	Lead acid batter	2	8,00(
	Battery Charg	1	6,00(
	Miscellaneous		3,00(
WELDING SHO			
1.	Electrical welding transformer set with accessc	3	30,00(
2.	Gas Cutting Un	1	3,00(
3.	Work benches with vic	3	5,00(
4.	Welding generator s	1	10,00(
5.	Oxy acetylene welding set with accesso	1	7,00(
6.	Acetylene generating s	1	6,00(
7.	Electric welder tool k	10	10,00(
8.	Projection welding machi	1	15,00(
9.	Brazing equipment with accessor	1	10,00(
10.	Soldering iron	3	1,00(

11.	Pedestal grinde	1	10,00(
12.	Metal spraying gu	1	10,00(
13.	Spot welde	1	25,00(
14.	TIG welding se	1	1,00,00(
15.	MIG welding se	1	1,00,00(
16.	Welding Partition Scre	5	2,50(
17.	Miscellaneou	LS	3,00(

Sr. No.	Descriptio	Qty	Total Pric (Rs)
FITTING AND PLUMBING SH(			
1.	Work benches with vices (4 vices on each be	5	30,00(
2.	Marking tables with scribe	4	24,00(
3.	Surface plate	5	20,00(
4.	Accessories like calipers, V blocks, height, gauges steel rules scribers	25	50,00(
5.	Tool kits– taps, dies, drill	25	40,00(
6.	Tool kits– chiesels, hammers, files, hacks	25	25,00(
7.	Drilling machin	2	12,00(
8.	Pipe vice	4	1,000
9.	Chainwrenche	5	1,250
10.	Ring spanner se	5	600
11.	Pipe die set 2	2 se	1,000
12.	Pipe bending devic	1	5,000
13.	Various plumbing fittin	LS	2,000
14.	Miscellaneou	LS	1,50(
SHEET METAL SHC			
1.	Hammer	8	3,000
2.	Mallets (Hard & So	5	2,000
3.	Sheet and wire Gang	LS	8,00
4.	Shearing Machin	1	20,00(
5.	Bar folding Machin	1	20,00(
6.	Burring machin	1	10,00(
7.	Various sheet (black plain, galvanized iron, corruga Aluminium)	1 Eac	1,000
8.	Hand Shears/Snippe	4	2,000
9.	Nuts, Bolts, Rivets, Scre	LS	5,00
10.	Miscellaneou	LS	1,00(
MASON SHO			
	Mason Trowe	10	1,000
	Concrete Finishing Trow	10	1,000
	Gauging Trowe	10	1,000
	Margin Trowe	10	1,000
	Pointing Trowe	10	1,000
	Round Trowe	10	1,000
	Mason/Brick Hamm	10	3,000
	Comb hamme	10	3,000
Sr. No.	Descriptio	Qty	Total Pric (Rs)
	Blocking chise	10	1,000

	Plumb bol	10	500
	Spirit leve	10	1,000
	Straight Edg	10	1,000
	Jointe	10	1,000
	Masonry Pa	10	1,500
	Steel Measuring Tap	10	500
	Miscellaneous (Bricks, Blocks, Stones, Sand, Cem	10	3,000
MACHINE SHO			
1.	Centre lathe	10	6,00,00
2.	Grinde	1	10,00
3.	Universal milling machi	1	1,25,00
4.	Shape	2	1,20,00
5.	Plaine	2	1,20,00
6.	Work bencl	3	10,00
7.	Precisio instrument	1	10,00
8.	Hand tools and accessori	2	8,000
9.	CNC trainer lath	1	4,00,00
10.	Miscellaneou	LS	5,00
Sr. No.	Particular	Uni	Aprox. Total Co
ENVIRONMENT ENGINEERING LABORATC			
	pH Mete	01	500
	Turbidity Mete	01	5000
	Oven with Temperature Controller and Forced Air Circulation	01	20000
	B.O.D. Incubato	01	25000
	Water Analysis K	01	5000
	High Volume Sampl	01	40000
	Electrical Balance for weighing upto 1/10 of milligram (capa	01	1000
ENERGY CONSERVATIOLABORATOR			
1	Clamp mete	02	5000
2	Multimete	02	2000
3	Power Analyse	01	20000
4	Different types of lamps (L 60 W lamp, 230 V, 100 V 200 W lamp 500 W lamp 100 Wlamp,110 V, 150 V	10	500
5	Lux mete	02	5000
6	Centrifuga pump, 1 kW	1	15,00
7	Standard window A.(	01	20000
8	Anemomete	02	5000
9	Thermomete	03	2000
10	Flow mete	02	10000
11	Pumping set with at least two pumps of different capa	1 se	10000
12	Pressure gauge fitted on discharge li	1 se	2000
13	Variable Frequency Dri	02	50000
14	A small compressor with a small network of pipe line fitted suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switc	1	3000
15	Stop watcl	2	1000
16	Small blower (1.5 kW motowith inlet and outlet ducts (approximately one meter length on both sides	1	10000
17	Black Box (for checking lamp efficacy including stand	1	25000

	luxmeter)		

Sr. No.	Description	Qty	Total Price (Rs)
MEASUREMENT AND INSTRUMENTATION LABORATORY			
	Measuring Instruments: Portable moving coil permanent magnet 150 mm uniform scale with anti parallax mirror, knife edge pointer, housed in wood/ebonite case, accuracy 1.5%	8	10,000
	a) Ammeter 0-5-10 Amp	6	7,200
	b) Ammeter 50 mA , 100 mA, 1000 mA	6	7,200
	c) Ammeter 0-10 Amp– 20 A	8	10,000
	d) Ammeter 0-2.5- 5 Amp	8	10,000
	e) Voltmeter 0-30 V	6	7,200
	f) Voltmeter 0-10-15 V, 0-200 – 300 V, 0-200-500 V		
	Stabilized DC Power Supply With maximum regulation of 0.0 0.05%Ripple in output less than 1 mv (rms), stability 0.2% + 30 mV, input supply 230V AC single phase, 50 Hz and DC output 0-100V,0-1.5Aand also with short circuit (0-30 V) and over load protection with measuring devices	8	32,000
	Lead Acid Batteries 12 V, 11 plates, 30 amp hour capa	2	6,000
	Battery Charger: SCR based automatic 12 V, AC input voltage V, output dc voltage-12 V, 0-2 amp. capacityprovided with voltmeter, Ammeter of suitable range	1	3,000
	Capacitors: enclosed in a polished hard wood/bakelite box, four brass terminals	6	1,800

	Hydrometer for measuring specific gravity of lead acid bat range 1100-1300	6	1,000
	Cell discharge tester: used for testing voltages of cells a batteries centre zero, housed in bakelite case with wooden handle movement, permanent magnet and moving coil type, knife edge pointer, range 3-0-3 volts	1	600
	Digital Multimeter: Three and lf digits LCD display,manual operated multimeter with AC/DC, 1A current resistance upto 10 Mohm, complete with leads manual and batteries, accuracy 0.5% for dc and 1% for AC measurement Voltage upto 1000V	1	750
	Earth tester: 500 volt, 0.1-100 ohms with 3/4 terminals, comple with all accessories (hammers, screw driver, 3 spikes with connecting leads, as per ISS) Accura± 1% FSD, housed in teal wood/ebonite case, with leather case	2	10,000

Sr. No.	Descripion	Qty	Total Pric (Rs)
	Moving Iron Voltmeter/Ammeter: Portable moving iron meast Instrument, housed in teak wood/ebonite case, scale 150 mm knife edge pointer, with anti mirror, critically damped, accuracy 1% FSD	2	2,000
	a) 0-500 mA-1000 mA	8	8,000
	b) 0-5-10 amp	1	1,000
	c) 0-2 amp	5	5,000
	d) 0-125-250 volts	4	4,000
	e) 0-250-500 volts		
	Wattmeter: Portable dynamometer type, housed in t wood/ebonite case, scale 150 mm knife edge pointer with anti parallax, current range -0-5-10 amp Voltage range -0-250-500 volt or 125-250 volt	3	7,500
	Rheostats: Sliding Rheostats wound with evenly oxidised iron nickel copper on vitreous enamelled round steel tube. Contac should be made of laminated phosphor bronze sheet. Resistance olerances± 2%	3	4,500
	a) Single tube 150 ohm- 2 A	3	5,000
	b) Singletube 300 ohm- 5 A	3	6,000
	c) Double Tube 500 ohms- 20 A, 30 A	3	6,000
	d) Double Tube 440 ohms- 3 A	3	6,000
	e) Double Tube 110 ohms- 10 A		
	Dimmerstat: Single phase-230 V, output 0-270 V, 10A	2	5,000
	Inductance: Coimounted provision for change in value, w polished teak board with terminals fitted with 2.5 Kg variable core	3	7,500
	Variable Inductor: Single phase, 250 V, mounted on well poli teak wood frame with terminals, 2.5 kW, continuously variable core type.	1	2,000
	Energy meters:	3	1,500
	single phase, induction type, 50 Hz, 5A/10A, 250 V, accuracy± 1%	3	3,000
	3 phase, Induction type, 4 wire,.440 V,-20A, 50 Hz, accuracy± 1%		
	Phase Regulator10A, 250V,2.5 KVA variable power factor a lagging to leading arrangement indicator	1	5,000
	Power Factor Meter: Dynamometer type, eddy current t damping, frequency 50Hz,scale length 150mm, current range	1	2,500

	upto20 amp, voltage range 300 volts, PF ran.5 lag,unity, 0.5 lead, Wood/ebonite, with antiparallax mirror, knife edge pointer		
Sr. No.	Description	Qty	Total Price (Rs)
	Load: 3 phase variable resistive load, 415 V, 10 KW, trc mounted tube type provided with switches to vary the load twenty steps, Continuously variable inductive load, 415 V, 10 kW terminal for end connections	2	10,000
	LCR/Q Bridge: Capable of measuring resistance inductive capacitance of range, 8 amps.0.012 to 10 Mega ohm, 4 to 10000 H, 0.5 pico farad to 10 F Direct reading of the factor from 0.15	1	4,000
	Frequency mete Digital, 4 digit LED display frequency meter suitable for use on 23 V AC main supply range 2 9 Hz Vibrating Reed type 230 V, having 21 reed 4 Hz. abs Body Moving Coil type portable housed in phenolic moulded body with antiparallax mirror. Scale and knife edge pointer, range 6 Hz, 230 V	30 1 1	1,500 1,000 1,500
	Phase sequence indicator: Portable, housed in a plastic mou casing, rotating disc type, supported with one meter long red, yellow and blue leads with clips, rating 30 sec. 500 V, burden 15 VA voltage 50 to 500 V (Horizontal) frequency 25 to 50 Hz.	1	500
	Thevenin Theorem Module: complete with accessories and measuring instrument, operated by 6 volt dc supply	1	2,500
	Norton theorem Module: Complete with accessories and measu instruments operated by 6 volt dc supply	1	2,500
	Maximum Power transfer theorem module complete v accessories and measuring instruments operated by 6 volt dc supply	1	2,500
	Transformer: Single phase, core type, natural air cooled, 230/11 1 KVA, 50H	1	2,000
ELECTRICAL MACHINES LABORATO			
	Static Converter: -Phase, 415 V, 50 Hz, output 230 V dc 15 K regulation + 1%, servo controlled, thyristorised	1	30,000
	DC Shunt Moto- DC shunt motor 230 V, 3 hp/3 kW, 1440 r complete with appropriate panel board with meters, switches, indicators starter and field regulator.	1	30,000
	DC Series motor: DC series motor with interpole/compensa winding, 230 V kw, 1440 rpm with breaking (eddy current or drum pulley) arrangement and appropriate panel board and over speed safety precautions e.g. light shunt winding etc	1	8,000
Sr. No.	Description	Qty	Total Price (Rs)
	DC Moto-alternator set: DC shunt mot 230 V, 3 kw, 1440 rpr coupled with 3 phase 440 V, 50 Hz alternator having damper winding with exciter complete with appropriate panel board, starter and field regulators	2	25,000
	Squirrel Cage Induction Motor-phase squirrel cage inductic moto 3 Kw, 415 V, 50 Hz, 1440 rpm all six terminals brought complete with appropriate panel board, starter etc.	1	6,000
	Slip ring Induction motor: Thr-phase, wound rotor inductic motor, 3Kw, 415 V. 50 Hz, 1440 rpm with stator and rotor terminals brought out coupled with a dc shunt generator, 230V, 3	1	20,000

	KW with appropriate panel board and sta		
	Single phase Induction Motor(various typ Capacitor start with centrifugal switch 0.5 KW with suitable loading arrangement and appropriate panel board.	1	3,000
	Servo motor: 230V, 50 Hz, Servo mc	1	10,000
	1-phase transformer: Single phase transformer, 230/115 V, 50 H KVA housed in a metal tank	4	12,000
	3-Phase transformer: Three phase transformer, 415/230V,50 H KVA allterminals brought out, housed in a metal tank	2	15,000
	Variacs Single phase, 230 V, 50 Hz, -A auto transformer continuously valuable, housed in a metal body, portable Single phase 230 V, 50 Hz, -A transformer continuousl valuable, housed in a metal body, portable Three phase, 230 V, 50 Hz, 30 A, 415 transformer continuously valuable housed in a metal body, portable phase	3 2 3	6,000 7,000 30,000
	Loading Rheostats: Resistance type, single phase 230V, 15A, each natural air cooled, housed in metal body fitted with switches and mounted on trolleys b) Resistance type, three phase 440V, 15A, natural air cooled, housed in metal body, switches and base wheels, six terminals brought out c) Continuously variable choke type loading coil, coil upto 15A, three phase, 440V, 50Hz, housed in a metal case on wheels (Trolley Aid) d) Capacitor bank, variable in steps through switches, 440V, 3 phase, 15A max. housed in a portable metal case	3 1 2 1	12,000 6,000 6,000 6,000

Sr. No.	Description	Qty	Total Price (Rs)
	AC motor Starters DOL starter, suitable for 415V, 3 Phase, 50 Hz, 3kw induction motor Auto transformer starter for 3 phase, 415 V, 50 Hz,5 Kw induction motor with facility of tappings Star-delta starter suitable for 415V, 3 Phase, 50 Hz, 5 kw induction motor (i) Manual (ii) Automatic	1 1 1 1	2,000 3,000 3,000 3,000
	DC Motor starters DC shunt motor starter three point suitable for 230V, 3 kw motor	1	3,000
	Rheostats: Wire wound Rheostats (Approx. of following ra 440 Ohm, 3A 110 Ohm 8A	 15 10	 4,500 3,000
	Tachometer: Digital non-contact type tachometers-10,000 rpm, 3 1/2 digit	4	8,000
	2.17 DC Ammeters: Portable moving coil permanent mag 150 mm uniform scale with anti parallax mirror, knife edge, pointer, housed in a teak wood/ebonite case, accuracy-5% a) Ammeter 0-3 amp b) Ammeter 0-25 amp c) Ammeter 0-50A	6 6 6	3,000 3,000 3,000
	DC Ammeters: Portable moving coil permanent magnet 150 uniform scale with anti parallax mirror, knife edge, pointer, housed		

	in a teak wood/ebonite case, accuracy -5%	4	3,000
	a) 0-15	2	1,500
	b) 0-50	3	2,250
	c) 0-150 d)	10	7,000
	0-300 e)	1	700
	0-600		
	AC Ammeters Portable moving iron, 150 mm uniform scale anti parallax mirror, knife edge pointer, housed in a teak wood/ebonite case, accuracy ±1.5%	3	3,000
	a) 0-1A	3	3,000
	b) 0-3A	7	8,000
	c) 0-10A d)	7	5,000
	0-20A		

Sr. No.	Description	Qty	Total Price (Rs)
	AC Voltmeters Portable moving iron 150 mm uniform scale anti parallax mirror, knife edge pointer, housed in a teak wood/ebonite case, accuracy ±1.5%	3	2,000
	a) 0-1V	3	2,000
	b) 0-15V	4	3,000
	c) 0-30/60 V	10	7,000
	d) 0-150/300 V		
	Multimeter		
	Digital/type: 3 1/2 digit LCD display manually operated multimeters with AC/DC 10 A and 10 mega ohm, accuracy ±0.5% for DC and ±1% for AC	2	2,500
	b) Indicating type DC voltage: Sensitivity 10 k ohm/v range 300 kV, 1, 3, 10, 30, 100, 300, 1000V; AC voltage sensitivity 10 K ohm/V Range 1,3,130, 100,300,1000V et	2	2,000
	Wattmeters: Portable dynamometer type: Portable dynamometer measuring instrument housed in a teak wood/ebonite case scale 150 mm, knife edge pointer with antiparallax mirror, critically damped, accuracy ± 1%		
	a) 75/300/600 V and 1.5/3A (LPF)	2	4,000
	b) 75/300/600 V and 1.5/20A (UPF)	2	4,000
	c) 75/150/300 V and 15/30A	4	8,000
	d) 110/220/440 V and 15/30A	4	8,000
	Portable Power factor meters: Dynamometer type, eddy current type, damping, frequency cycle 50 Hz , scale length 150 mm, current rated upto 20A, Volt 300V. p.f. range 0.5 lag unity 0.5 lead, housed in teak wood/ebonite case with antiparallex mirror with knife edge pointer	1	2,500
	Portable type single phase single element type 110 V/240 V or 1 A or 5 A	1	2,500
	Portable type 3 phase single element type 110 V/ 240 V, 1 A or 5 A		
	Frequency Meter		
	Pointer type Portable type housed in phenolic moulded body with ant parallax mirror scale knife, edge pointers range 40-60 Hz, 230 V, 110 V or 240 V or 45-55 H	1	1,500
	b) Read type 230 V, range 40-60 Hz and 21 Read	1	1,500
	Digital type. 3 1/2 digit: LED, display frequency meter suitable for		

	use on 230V AC main supply range 45-99Hz	1	1,000
Sr. No.	Description	Qty	Total Price (Rs)
	Synchroscope: Suitable for 110V AC-phase, 50 Hz alongwith potential transformer, 230V and 415V on primary and 110V on secondary side	1	2,500
	Tong Testing Ammeter:-15 A/50A/100A Cli-on type	1	3,000
	Current Transformer: 10-50-25-10/5A	2	1,000
INSTALLATION, MAINTENANCE & REPAIR LABORATORY			
	Coil Winding Machine: Bench mounted, power driven with clutch and brake built into winding head, electromagnetic traverse clutch system for setting winding length of wire range .05 to 1.5 mm dia. Max. winding speed 250 to 5500 rpm speeds, coil dimensions Max. dia 150 mm, electric motor 0.5 HP, 1725 rpm, 230 V AC single phase, 50Hz with essential spare	1	10,000
	Bench Drilling Machine: Drilling capacity 13 mm, slotted and adjustable drilling, Table size 250 x 250 mm app. Belt driven with 4 speed ranges from 50 to 2000 rpm, electric motor power 0.5 kw. suitable for an electrical supply of 240 V AC single phase 50 Hz	1	5,000
	Portable Drilling Machine: Hand electric drill machine with speed control having specification Drilling 10 mm, no load speed 700 rpm ,435 W capacity, Supply voltage 230 V, 50Hz supply	3	3,000
	Multi meter: Laboratory service type with large and easy read mirror scale with over head protection high accuracy, voltage range a.c/ d.c-600 V Current Ranges- AC 50 mA - 10 amp.DC 10 mA- 10 amp Ohmmeter 2 Ohm to 2 K Ohm Accuracy DC voltage and current ±1% AC voltage and current ± 2%, Ohmmeter + 3% with test leads and carrying case	2	3,000
	Meggar: Insulation tester having hand driven generator to generate 500 volts DC having effective range of measuring insulation resistance from 0 to 100 MOhm. Confirming to IS 2992/1965	2	6,000
	Fans of various type with one having solid State speed regulator: Ceiling fan: 1200 mm, 1500 mm sweep operating at 230V, 50Hz, supply AC Table fan: 400 mm sweep operating at 230 V, 50 Hz, supply AC Exhaust fan: 375 mm sweep operating at 230 V, 50 Hz, supply AC main 0.25 HP Desert cooler, complete with 375 mm sweep, 1400 r 1/4 HP motor operating at 230 V, 50 Hz, AC, complete supporting frame fan, water circulating pump, float and control switches etc.	 1 1 1 1	 1,000 1,000 2,000 5,000

Sr. No.	Description	Qty	Total Price (Rs)
	Electrical Appliance		
	1. Electric Kettle: 750 watts, 230V single phase AC, 50Hz, capacity 1 lit.		
	a) Filament type	3	2,000
	b) Rod type rated 1000 watt.	3	2,400
	2. a) Electric Iron, 500 watt, 230 V, Ordinary, 50 Hz, 1 Kg weight	6	1,800
	b) Electric Iron, 500 watt, 230 V, Automatic, 50 Hz, 1/2 Kg	6	3,000
		1	800
	3. Electric Toaster: 500 watt	2	6,000
	4. Geyser 15 lit capacity, 2 Kw, 230 Volts 50 I AC	12	3,600
	5. Immersion rod: 1000 watt, 230 Volts 50Hz, AC supply operated	6	2,400
		6	2,400
	6. Room Heater 1000 watt, 230 V, 50 Hz, AC supply	2	3,000
	Parabolic type	1	3,000
	Rod type (single rod/double rod)		
	Air convector: 1000 watts, 230 V, 50 Hz, with 2 temperature settings	6	3,000
	Mixer cum grinder: 250 watts, 230 volts, 50 Hz, 1 1/2 lit. capacity with various attachments (food processor)	2	3,000
		4	4,000
	9. Heater: Wire wound type, 1000 watts, 230 V, 50 Hz supply		
	10 Induction plate 2kW, 220V 1 ø A/C	1	2,000
	11. Hot plate: Single/double filament 1500/2000 watts, with control knobs operating at 230 V, 50 Hz, AC supply	2	14,000
	12. Electrical Oven: 2 KW, with temperature control devices and temperature indicating meters operating at 230 volts, 50 Hz AC supply	1	2,500
	13. Refrigerator 165 litres	1	4,000
	14. a) Washing Machine: 0.5 HP washing machine to be operated at 230 V 50 Hz, AC 20 lit. cap. round tank type	1	1,000
	b) Washing Machine: 0.5 HP washing machine to be operated at 230 V 50 Hz, AC 6.5 lit. semi automatic	1	200
	15. Electric Shaver: 460 watts, to be operated at 230 V, 50 HP supply		
	16. Electric Lighter: to be operated at 230 v, 50 Hz		
	Electric/Electronic		

Sr. No.	Description	Qty	Total Price (Rs)
1.	Armature Growler: Armature testing growler suitable for finding faults in armature like open circuit, short circuit, ground fault, turn to turn fault and horted commutator etc. Suitable to work on 230V 50 Hz ac supply, Growler should be provided with testing probs and meters to indicate faults	1	2,000
2.	Digital clip-on meter: Digital Clip -on meter with	3	3,000

	following specifications: i) Display 3.5 digits ii) Max. reading 1999 iii) AC current Resolution Accuracy Range 200 Amps to 100 mA ±1.25 to 5 digit 100 Amps to Amp iv) AC Voltage 2000 V to 0.1 V : ±1% to 5 digit 1000 V to 0.1 V : ± 1% to 5 digit v) Resistance 200 M Ohms to 0.1 ohms ± 1.00% Instruments should be provided, with test leads and carrying case		
3.	Electric Blower: for cleaning equipment, powerful light weight with flexible hose 2 mts long complete with mains cable, standard Accessories i.e. Suction arrangement, hot air attachment, spray attachment suitable for an electric supply of 230 V 50Hz AC	1	6,000
4.	Miniature Circuit Breakers(MCBs) a) 16, 40 and 60 amps in single phase b) 100 amps 3 phase c) 200 amps 3 phase	 6 each 6 each 6 each	1,200 1,800 1,200 1,800
5.	Oil Testing Set: Oil testing set as per ISI 6792/1972 input voltage 220 -250 volt, 50 Hz AC Output voltage 0 - 50 kv, accuracy +.4% of FSD Rate of rise of voltage automatic 2 Kv/Sec motorised	1	10,000
6.	Electric Lamps: a) Mercury vapour lamp 120 watt, 230v, 50 Hz AC supply complete with choke, lamp holder and power factor capacitor b) Mercury vapour lamp ML type 120/125 watt, 230 v, 50 Hz supply c) Sodium vapour lamp 120 watt/250 watt, 230 volts, 50 Hz with choke d) Flourescent tube: 20/40 watt, 230 V,50 Hz, single phase with choke, starter and fittings various sizes and types i.e. round etc. e) Halogen lamps: 1000 watts/1500 watt, 230 v, 50 Hz complete with fittings(Fluorescent tube light) f) LED Tube	 2 2 4 2 1 50	 5,000 4,000 8,000 400 300 20,000
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
	g) Filament Lamps - 60 W lamp, 230 V - 60 W lamp, 100 V - 60 W lamp, 230 V - 200 W lamp - 500 W lamp	 100 100 100 100 100	 1,000 1,000 1,000 1,500 1,500

	- 100 W – 110 V lamp - 100 W - 150 V lamp h) CFL LAMP i) LED bulb 10W	100 100 50 100	1,500 1,500 7,500 10,000
7.	Emergency Light: a) 55 cm long, with 6 volts battery suitable for vertical and horizontal position b) (Fluorescent tube light) portable type twin tube 1"(25.4 mm) long with 6 volts battery for vertical and horizontal position	 1 1	 500 500
8.	Voltage Stablizer: 500 VA, input 170/260 volts, output 210 - 240 volts automatic with voltmeter	2	2,000
9.	Bridge Insulation Tester: Transistorized battery operated bridge insulation tester battery operated push button indications built in wheat stone bridge Varley and Murray loop facilities for finding cable faults bridge suitable for 0.01 m to 11 m available in length of 200 - 1000 meters	1	5,000
10.	Automobile Electrical Wiring Demonstration working model for automobile Electric wiring	2	6,000
11.	Screw Driver Set: Electrician type round nickel plated steel blade, flat tip with plastic insulated handle following sizes: Blade Sizes i) 2.5 x 60 mm ii) 3 x 80 mms iii) 4 x 120 mm iv) 5 x 160 mm v) 5 x 200 mm	6 each	1,000
12.	Combination Pliers: 205 mm length with thick plastic insulated handle Insulated for 500 V (Taparia, PYE make)	8	2,500
13.	Long Nose Pliers: 150 mm insulated for 500 volts	12	1,000
14.	Diagonal Pliers: 150 mm insulated for 500 volts suitable for cutting hard wires	6	600
15.	Adjustable Wrench Chromium plated adjustable wrench lengths 255 mm max. opening 30 mm	6	3,000

Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
16.	a) Flat nose pliers: Rectangular section jaw and smooth gripping surface plastic insulated handles length 130 mm b) Slip Nose Pliers with slim long grains of half	3 each 6	300 300

	round section and smooth gripping surfaces plastic insulated handle length 130 mm c) Round Nose Pliers: With slim long round grains and plastic insulated handles lengths 13 0 mm	3	300
17.	Ball Pien Hammer: Ball pein hammer with polished fall and pe in wooden handle having wts i) 250 gms ii) 500 gms iii) 800 gms	3 each	500
18.	Screw Holding Screw Driver Set: Screw driver set fitted with spring each clips to secure screw head round or hexagonal chromium plated blade with plastic handle set of three screw driver blade size i) 4 x 50 mm ii) 4 x 75 mm iii) 4 x 100 mm	6	400
19.	Instrument Makers Screw Driver Set: Set of screw drivers with chrome vanedium set steel shaft and fluted nickel plated steel handle with hexagonal end shaft width 0.8 to 3.8 mm complete with plastic case	2	300
20.	Tweezers a) With blunt serrated Jaws stainless steel nickel plated length 160 mm b) Pointed ends serrated jaws stain less steel nickel plated length 130 mm	1 1	50 50
21.	Work shop Scissors Stainless steel, scissors suitable for cutting insulation, paper, plastic etc. length approx. 150 mm	6	300
22.	Adjustable Hacksaw Frame: Extra robust tubular steel frame cast handle adjustable for hacksaw blade from 250 - 300 mm with set of 10 spare blades	4	300
23.	Hand Drill Machine: Two speed hand drill machine with enclosed gear adjustable crank, supporting handle, self centering chuck for straight shank drills upto 10 mm	6	900
24.	Bench Vice: Drop forged steel bench vice with jaw width 100 mm, Jaw opening 120 mm, Jaw depth 75 mm, quick release complete with i) One pair of detachable aluminium protective jaw plates ii) One pair of detachable fibre protective jaw p lates	2	800

Sr. No.	Description	Qty	Total Price (Rs)
25.	Bearing Puller Three legs heavy duty bearing puller of size 100 mm/200 mm	1	400

26.	Automatic Centre Punch: Spring loaded action knurled shank centre punch length 115 mm and dia at point 2mm	2	200
27.	Wire Gauge: Suitable upto 0 -76 SWG	1	200
28.	Try Square: Engineers try square from stainless steel with stock 90 degrees all sides accurately finished legs 150 x 100 mm	2	100
29.	Measuring tape: Pocket measuring tape of steel spring return device, flexible, clearly graduated in metric readings 2 mts long	6	200
30.	Files Set: Hand files with plastic handles for each general metal treatment double cut 200/350 mm long consisting of i) Flat smooth cut ii) Flat second cut iii) Half round second cut iv) Half round smooth cut v) Round second cut vi) Round smooth cut vii) Square second cut viii) Square smooth cut ix) This single cut smooth 20 x 3.3mm x) Triangular file 200 mm	2	1,000
31.	Wire Stripper: Stripper with side mounted spring return and adjustable jaws via look screws for cable insulation maximum 4 mm dia length 150 mm.	2	100
32.	Screw Driver Mains Voltage Tester: Flat tip screw driver with built in new test lamp transparent plastic handle insulated bloc k, metal pocket clip suitable upto 400 v. AC blade 4 x 100 mm Overall length 180 mm	2	100
33.	Cable Knife: Electrician knife blade made from stainless steel with length 50 mm plastic moulded handle overall length 180 mm	12	100
34.	Soldering Gun Kit: Instant action soldering device trigger controlled with built in illumination of soldering butt bakelite housing, normal power 45 watts, with approx. 2 mts supply cord suitable for electric supply of 230 volt AC, single phase 50 Hz. Accessories: (i) Fine bit (ii) Bit for plastics	3	6,000
35.	Rubber Mallet: Soft Rubber with wooden handle approx. 200 gms	6	300
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
36.	Screw Extractor Set: Left hand thread for easy removal	3	300

	of broken right hand threaded screw and bolts.Set of three extractors for screws with die from 3 to 11 mm Figure Stamp Set for marking made from high grade stainless steel figure height 4mm complete with plastic box		
37.	Letter Stamp Set: Made from high grade steel, character set hei ght 4 mm, full set of alphabets complete with plastic box	2	200
38.	L - End Key Set: a) Metric set of 10 wrenches from 1.5 to 10 mm complete with plastic wallet 4 set b) Imperial set of 7 wrenches from 1/16" to 1/4" complete with plastic set wallet	1 1	100 200
39.	Box Spanner Set: Round shank in chrome vanadium steel Hexagonal socket plastic handle set of nine spanners sizes 3, 4, 5, 6, 7, 8,10, 12 and 14 mm overall length 150 mm	1	200
40.	Open Ended Spanner Set: Double ended chrome vanadium steel jaws, jaw angle 15' oval shank set of 8 spanners. Jaw width 4x5, 5x5, 6x7, 7x8, 9x10, 10x12, 12x14 mm	2	800
41.	Soldering Iron: Soldering iron 35 watts, 65 W, 100 Watts operating at 230 V, 50 Hz supply	2	300
42.	Oil Can: 0.75 lit capacity	2	100
43.	Blow Lamp: 1 Pint kerosene oil capacity blow lamp	3	400
44.	Hand Saw: Hand saw 10" (254) size 10 teeth per inch teak wood handle	6	300
45.	Chisels: Former chisel mode of carbon steel of size 6 mm x 15 mm	3	150
46.	Wrench Set: Set of 5(3/8 to 1 inch) chrome vanadium sets steel, offset type, points, accurately sizes capacity 3/8x7/16, 1/2x9/16, 5/8x1/16, 3/4x7/8 and 15/16x1 inch (in metric sizes)	2	1,000
47.	Pipe Wrench: High tensile steel, drop forged, hardened and tempered app. cap. 6 to 50 mm dia	3	500
48.	Tap Wrench Set: Set of 4, bar type, adjustable for general purpose, made of best quality steel, approx. cap. 1.5 to 25 mm square	6	1,500
49.	Electric Pneumatic Drilling Hammer: Drill capacity, 5 -22 mm in concrete, 5 -10 mm in steel rated voltage 235 volts, 50 Hz, AC, full load input 450 watt, full load speed 650 rpm. Impact rate 3270 Blows/minute	1	1,500
50.	Work Bench: Steel construction but with wooden bench top not less than 50 mm thick with two steel drawers both lockable approx. size 1200x600x850 mm solid construction	1	1,500
Sr.	**Description**	**Qty**	**Total Price**

No.			(Rs)
51 .	Fire Extinguisher: Multipurpose fire extinguishers, suitable for electric installation and petrol fire, app. cap. 10 kg. rechargeable includes wall bracket and 2 recharging kits	5	5,000
52 .	Tube light, 230V, 50HZ, 1 -Ø	10	500
53 .	Starter, 230V, 50HZ, 1 -Ø for Tube Light	10	400
54 .	Choke, 230V, 50HZ, 1 -Ø for Tube Light	10	1,000
55 .	Alarm bell electric, 230V, 50HZ, 1 -Ø	6	900

DIGITAL ELECTRONICS AND MICROPROCESSORS LABORATORY

.

1.	DC regulated low voltage variable power supply	6	15,000
2.	DC regulated multiple output power supply	3	9,000
3.	Digital IC power supply	8	10,000
4.	Electronic Digital Multimeter	6	9,000
5.	CRO Dual trace, 25 MHz	4	1,00,000
6.	Digital frequency meter/universal Counter timer	2	20,000
7.	Pulse Generator	2	10,000
8.	Logic probes (TTL and CMOS)	10	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Microprocessor trainer Kits 8085	10	50,000
12.	Microprocessor Trainer Kits 8086	2	60,000
13.	Computer Trainer	1	30,000
14.	Interfacing Cards	5	2,50,000
15.	Micro -controller Kit 8051 based	10	1,00,000
16.	Digital IC Tester	1 No.	50,000
17	Universal Programmer	2No.	7,000
18	Digital Multimeter	10 No.	60,000
19.	EPROM Programme	2	10,000
20.	EPROM Eraser	2	1,500

INDUSTRIAL CONTROL LAB

S.NO	NAME OF EQUIPMENT	NUMBER	RS/UNIT	AMOUNT IN RS.
1.	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a) single phase fully controlled bridge (b) Firing pul se Generator digital type with triggering cricket control switches.	01	50,000=00	50,000=00

	(c) Voltmeter (0 -300V) (d) Ammeter (0 -5amp) (e) 1:10 attenuator for CRO (f) Isolated 220V ac for CRO (g) MCB (h) Different testing points 2.Separately excited D.C motor of 1 HP 220v armature voltage and field current control arrangements 3.connecting leads 4.lamp and lamp holder			
2	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a) single phase half controlled bridge (b) Firing pulse Generator digital type with triggering cricket control switches. (c) Voltmeter (0 -300V) (d) Ammeter (0 -5amp) (e) 1:10 attenuator for CRO (f) Isolated 220V ac for CRO (g) MCB (h) Different testing points 2.Separately excited D.C motor of 1 HP 220v armature voltage and field current control arrangements 3.connecting leads 4.lamp and lamp holder	01	50,000=00	50,000=00
3	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a) Dual converter with centred tap inductor required for circulating mod e operation of dual converter (b) Microcontroller based firing cricket and control switches. (c) Voltmeter (0 -300V) (d) Ammeter (0 -5amp)	01	50,000=00	50,000=00

	(e) MCB (f) Different testing points 2.Separately excited D.C motor of 1 HP 220v armature voltage and field current control arrangements 3.connecting leads 4.lamp and lamp holder			
4	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a) MOSFET/IGBT CHOPPER for getting a variable dc voltage by using on time control and frequency control to feed separately excited DC motor (b) Microcontroller based firing cricket and control switches. (c) Voltmeter (0 -300V) (d) Ammeter (0 -10amp) (e) MCB (f) Different testing points (g) 110v DC supply 2.Separately excited D.C motor of 1 HP 220v armature voltage and field current control arrangements 3.connecting leads 4.lamp and lamp holder	01	45,000=00	45,000=00
5	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a)single phase ac voltage controller (b) Microcontroller (805 1 or other) based firing cricket for single phase ac voltage controller and control switches. (c) Voltmeter (0 -300V) (d) Ammeter (0 -10amp) (e) MCB (f) Different testing points (g) Patch card (h) isolation transformer provided for 220v	01	45,000=00	45,000=00

	for CRO (i) 1:10 attenuator for CRO (j) digital techometer 2.Single phase AC motor capacitor run 0.5 HP ,220V and control arrangements 3.connecting leads 4.lamp and lamp holder			
6	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a)Three phase ac voltage controller(i.e six SCR connected in anti -parallel) (b) Microcontroller(8051 or other)based firin g cricket for three phase SCR bridge ac voltage controller and control switches. (c) Voltmeter (0 -300V) (d) Ammeter (0 -10amp) (e) Three phase MCB (f) Different testing points (g) Patch card (h)Three phase isolation transformer (i) 1:10 attenuator for CRO (j) digital tachometer (k) soft push buttons provided for increasing and decreasing the firing angle with LCD display 2.Three phase 415Volt 1.0 HP 1440 RPM squirrel cage induction motor coupled to DC shunt generator 230v with lamp bank load 3.connectin g leads 4.lamp and lamp holders	01	75,000=00	75,000=00
7	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a)Three phase voltage source inverter (b) Microcontroller base SCR bridge controller (c) Voltmeter (0 -300V) (d) Ammeter (0 -10amp)	01	75,000=00	75,000=00

	(e) Three phase MCB (f) Different testing points (g) Patch card (h)Three phase auto transformer base variek (i) 1:10 atten uator for CRO (j) digital tachometer (k) soft push buttons provided for increasing and decreasing the firing angle with LCD display 2.Three phase 415Volt 1.0 HP 1440 RPM squirrel cage induction motor coupled to DC shunt generator 230v with lamp bank load 3.connecting leads 4.lamp and lamp holders			
8	An iron base table with wooden top in which the motor should be mounted on MS base provided with antvibration rubber mounting and engraved panel board. **1.Engraved Demonstration Board should have:** (a)Three phase bridge rectifier (To convert 3-phase rotor supply to dc supply for slipring induction motor) (b) Voltmeter (0 -300V) (c) Ammeter (0 -10amp) (d) Three phase MCB (e) Different testing points (f) Indicators to DC supply (g) digital tachometer (h) glass fuse connected series with the DC supply (i) IGBT -chopper control circuit with proper heat sink (j) Snubber circuit (k) Driver for MOSFET control based circuit (l) soft start and soft stop buttons provided for driver output 2.Experimental setup with 1.0 H.P slip ring induction motor,415v 50Hz 1440 rpm 3.connecting leads 4.lamp and lamp holders	01	75,000=00	75,000=00
9	For testing and fabrication of fan speed regulator (electronic type)			

	(1)Single phase variek 23((2) Voltmeter (0300V)ac type (3) Ammeter (010amp)ac type (4) MultiMeter (5) soldering gun, paste , iron (6) various electronics components (7) connecting wires			

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Con Centre etc will be required for effecti implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to made.

(C) Furniture Requirement

Norms and standards laid down by AICTE be followed while working out furniture requirement for this course.

10.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluatic

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

Theory
Practical Work (Laboratory, Workshop, Field Exercises)
Project Work
Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for subjects may be caused through sessional /class tests, home assignments, tutorial work, seminars, and group discussions etc. For end term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate studs' performance in knowledge, comprehension and at the most application do only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior persons (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital ro in planning instructional experiences for the courses in four different environments viz. class, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for he teachers to understand curriculum document holistically and further be aware of intricacies of t- learning process (TL) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, coordination upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepa academic plan at department level referring to institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given tim judiciously by planning a above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T process effectively:

1. Teachers are required to prepare a course plan, taking into account department plan, number of weeks available and courses to be taught

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of content covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g attention, state instructional objectives, help in recalling prerequisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignment and seminar can be thought of as terminal outcome of library experience

5. Concept and content based field visits may be planned and executed for such content of course which is nature and no other resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are to use problem based learning/activity learning/ experiential approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answersheets immediately and giving constructive feed back to every stu

8. The student centred activities may be used to develop generic skills like task management, problem solv managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than delivery based conventional teaching all the

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern for wastage o other resources etc.

12. Students may be given relevant and well thought out project assignments, which are purposeful and develo practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned dept of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

13. LIST OF PARTICIPANTS

The following experts participated in workshop for Developing the Curricula Structure and Contents of various Diploma Programmes for UP State, 16th April to 5th April, 2018 at NITTTR, Chandigarh:

1. Sh. Pankaj Yadav, Assistant Director, Directorate of Technical Education, Kanpur
2. Sh. Lal Ji Patel, Text Book Officer/CDC Officer, IRDT, Kanpur
3. Mohd. Qamruzzaman, Lecturer English, Government Polytechnic, Kanpur
4. Sh. Anjani Kumar Sharma, HOD, Chemical Engg. Government Polytechnic, Chandari
5. Dr. Balram, Lecturer Maths, Government Polytechnic, Lucknow
6. Sh. Sanjay Kumar Singh, Lecturer, Electronics, Government Polytechnic, Aurai, Bhadohi, UP.
7. Sh. Nirdosh Kumar, Lecturer, Electrical Engg. Government Polytechnic, Naraini, Banda
8. Sh. Vinod Sonthwal, Lecturer, Civil Engg. NITTTR, Chandigarh
9. Sh. Vikas Choudhary, Lecturer, Civil Engg. Government Polytechnic, Changipur, Bijnor
10. Sh. Ashish Kumar, Head, Mechanical Engg. Government Polytechnic, Narwana Khurd, Meerut
11. Sh. Gopal Chandra Nayak, Assistant Professor, Regional Institute of Co-operation, Chandigarh
12. Sh. Amit Doegar, Assistant Professor, Computer Science and Engg. NITTTR, Chandigarh
13. Dr. Kanika Sharma, Assistant Professor, ECE, NITTTR, Chandigarh
14. Mrs. Shano Solanki, Assistant Professor, Computer Science and Engg. NITTTR, Chandigarh
15. Dr. Lini Mathew, Associate Professor, Electrical Engg. NITTTR, Chandigarh
16. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh
17. Mrs. Rama Chhabra, Associate Professor, CDC, NITTTR, Chandigarh
18. Dr. AB Gupta, HOD, CDC, NITTTR, Chandigarh
19. Sh Roshan Lal, Sr. Lecturer, Kalpana Chawla Govt. Polytechnic for Women, Ambala City
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21. Sh. Kamal Kumar, Lecturer, Computer, Government Girls Polytechnic, Lucknow
22. Sh. Pavesh Verma, Deputy Secretary, Board of Technical Education, Lucknow
23. Dr. Dinesh Yadav, Lecturer, Physics, Government Polytechnic, Bareilly
24. Dr. Yogendra Singh, Lecturer, Chemistry, Government Polytechnic, Ghaziabad
25. Professor Seema Kapoor, DUCSEIB, Panjab University, Chandigarh
26. Sh. Navdeep Singh, Sr. Lecturer, Computer Sc. Engg. Government Polytechnic, KhuniMajra, Mohali
27. Sh. Gurmail Singh, Sr. Lecturer, ECE, Government Polytechnic, KhuniMajra, Mohali
28. Dr. Shimi S.L., Assistant Professor, Electrical Engg. NITTTR, Chandigarh

The following experts participated in workshop for Developing the Curricula Structure and Contents of various Diploma Programmes for UP State, 19th April to 18th April, 2018 at NITTTR, Chandigarh:

1. Sh. Ram Partap Singh, Instructor, Drawings, Government Polytechnic, Kanpur
2. Sh. Narendra Kumar, Workshop Superintendent, Government Polytechnic, Kanpur
3. Sh. Rajeev Kumar, Workshop Superintendent, Government Polytechnic, Jaunpur
4. Vikas Choudhary, Lecturer, Civil Engg. Government Polytechnic, Changipur, Noorpur Bijnor
5. Sh. Rahul Singh, Lecturer, Civil Engg. Government Polytechnic, Changipur, Noorpur Bijnor
6. Sh. Lal Ji Patel, Text Book Officer/CDC Officer, IRDT, Kanpur
7. Sh. Kamal Kumar, Lecturer, Computer, Government Polytechnic, Lucknow
8. Sh. Sheetanshu Krishna, Government Polytechnic, Amethi
9. Sh. Amit Doegar, Assistant Professor, Computer Science and Engg. NITTTR, Chandigarh
10. Sh. Shirish Tripathi, Government Polytechnic, Unnao
11. Sh. Sanjay Kumar Singh, Government Polytechnic, Aurai, Bhadohi, UP
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13. Mrs. Himmi Gupta, Assistant Professor, Civil Engg. NITTTR, Chandigarh
14. Ms. VarshreeGangwar, Lecturer, Chemical Engg. Government Polytechnic, Kalyanpur
15. Dr. Poonam Syal, Associate Professor, Electrical Engg. NITTTR, Chandigarh
16. Dr. P. Sudhakar Rao, Assistant Professor, Mechanical Engg. NITTTR, Chandigarh
17. Sh. PK Singla, Associate Professor, CDC, NITTTR, Chandigarh
18. Mrs. Rama Chhabra, Associate Professor, CDC, NITTTR, Chandigarh
19. Mohd. Rizwanullah Siddiqui, HOD, Electrical Engg. Government Polytechnic, Lucknow
20. Sh. O.P. Choudhary, Lecturer, Electrical Engg. Government Polytechnic, Lucknow
21. Sh. Tushar Kiran, Lecturer, Mechanical Engg. Government Polytechnic, Lucknow
22. Sh. HeeraSiddiqui, Lecturer, Chemical Engg. Government Polytechnic, Lakhiurpur

23. Sh. R.P. Bhardwaj, Workshop Superintendent, Aryabhat Institute of Technology, Delhi
24. Dr. AB Gupta, HOD, CDC, NITTTR, Chandigarh

The following experts participated in workshop for Developing Curriculum Contents of 1st year of 6 diploma programmes for UP State on 4th May, 2018 at State Board of Technical Education, Lucknow:

1. Sh. S.K. Govil, Ex Secretary, SIMUJEEC
2. Dr. Amrita Mishra, Lecturer, Chemistry, Government Polytechnic, Lucknow
3. Sh. Ashok Kushwaha, Head, Computer, Government Polytechnic, Lucknow
4. Sh. Faizan Ahmad, Lecturer, Chemical Engg., Sanjay Gandhi Polytechnic, Jagdishpur, Amethi
5. Dr. Kalpana Singh, Lecturer, Physics, Government Polytechnic, Lucknow
6. Sh. Alok Srivastava, HOD, Civil Engg. Government Polytechnic, Shahjahanpur
7. Dr. Vinod Kashyap, Lecturer, English, Government Polytechnic, Lucknow
8. Sh. Rakesh Kumar, Lecturer, Electronics, Government Polytechnic, Barabanki
9. Sh. Subhash Chandra Misra, Retired Sr. DDG, BSNL, DOT, GOI
10. Sh. Brijesh Mishra, Softpro In
11. Sh. Ajay Choudhary,, Softpro India
12. Sh. FR Khan, JEEC, UP
13. Sh. K. Ram, Joint Director, (CZ)
14. Sh. Manish Kumar, Lecturer, Government Polytechnic, Unnao
15. Sh. Prabhakar Tiwari, HOD, Electrical Engg. Government Polytechnic, Premdharpatti, Pratapgarh
16. Sh. RK Singh, HOD, Electronics, Government Polytechnic, Pratapgarh
17. Ms. Rashmi Sonkar, HOD, IT, Government Girls Polytechnic, Faizabad
18. Sh. Ankit Gupta, Lecturer, Mechanical Engg. Government Polytechnic, Lucknow
19. Ms. Meenu Dwivedi, Lecturer,Mechanical Engg. Government Polytechnic, Lucknow
20. Sh. Sanjay Kumar Srivastava, Tata Motors Ltd., Lucknow
21. Sh. Kamal Kumar, Lecturer, Computer, Government Girls Polytechnic, Lucknow
22. Sh. Manoj Kumar, Director, IRDT, Technical Education, Kanpur
23. Sh. RC Rajput, Director, Technical Education, Kanpur
24. Sh. Sanjeeva Kumar Singh, Secretary, Board of Technical Education, Lucknow
25. Sh. Pravesh Verma, Electrical Engg. Board of Technical Education, Lucknow
26. Sh. Lal Ji Patel, Text Book Officer/CDC Officer, IRDT, Kanpur
27. Sh,. Ashrapal, Principal, Government Polytechnic, Tundla, Firozabad
28. Smt. Rashmi Sonkar,Head of department(I.T),GGP Ayodhya
29. Sh. Sandeep Kumar, Lecturer, Computer, Government Polytechnic, Allahabad
30. Sh. Umesh Chand Yadav, Government Polytechnic, Lucknow
31. Sh. OP Chaudhari, Lecturer, Government Polytechnic, Lucknow
32. Dr. AB Gupta, HOD, CDC, NITTTR, Chandigarh

The following experts have participated in workshop for diploma course in Electrical Engineering for UP State on 30-31.01.2019 at IRDT, Kanpur

1. Mr. Alok Kumar Srivastav, HOD, Electrical Engg., Govt. Polytechnic, Bindki, Fatehpur,UP
2. Mr. Sunil Kumar, Lecturer, Electrical Engg. Govt. Polyechnic, Kanpur
3. Mr. Suneel Kumar Suraj, Lecturer, Electrical, Govt. Polytechnic, Puwayan, Shahjahanpur
4. Mr. Rizwanullah Siddique, HOD, Electrical, MMIT, Shravasti
5. Mr. Dinesh Kumar Yadav, Lecturer, Electrical Engg. Govt. Polytechnic, Lucknow
6. Mr. Sunil Kumar Sonkar, Assistant Director, DTE, Kanpur
7. Mr. VB Nag, SDE, BSNL, O/o TDM, Unnao
8. Mr. Arun Kumar, Principal/HOD, SGSJ Polytechnic Khurja
9. Mr. SK Singh, Electrical Engg. KESCO
10. Sh. Ashok Kushwaha, IRDT, Kanpur
11. Sh. Yogesh Singh, HOD, Electrical Engg. IRDT, Kanpur
12. Sh. Ankit Kumar, Lecturer, Govt.Polytechnic, Moradabad
13. Sh. Parvesh Verma, Board of Technical Education, Lucknow
14. Sh. Manoj Kumar, Director, IRDT, Kanpur
15. Dr. AB Gupta, HOD, CDC, NITTTR, Chandigarh

The following experts have participated in workshop for diploma course in Electrical Engineering (Industrial Control) for 2nd and 3rd year of UP State on 29.05.2019 at Government polytechnic Lucknow organized by IRDT, Kanpur:

Sh. L.P.Singh , HOD Electrical Engineering , Government polytechnic Jamuniadeeh , Harakh, Barabanki
Sh. Dinesh Kumar Gautam , HOD Electrical Engineering , Government polytechnic Deoria.
Sh.Virendra Kumar Chaudhary, Lecturer Electrical Engineering, Government Girls polytechnic Lucknow.
Sh. Dinesh Kumar Yadav, Lecturer Electrical Engineering, Government polytechnic Lucknow.
Sh. Ajay Prakash Narayan , Lecturer Electrical Engineering, Government polytechnic Kanpur
Km. Shilpi Gupta , Lecturer, I&C Engineering, Government Girls polytechnic Lucknow.
Sh. Yogesh Singh , Professor , IRDT , Kanpur
Sh. Ashok Kushwaha , Text Book Officer , IRDT Kanpur

The following experts have participated in workshop for diploma course in Electrical Engineering (Industrial Control) for Finalizing 2nd and 3rd year of UP State on 30.06.2019 at Government polytechnic Lucknow organized by IRDT, Kanpur:

Sh. L.P.Singh , HOD, Electrical , Government Polytechnic Jamuniadeeh Harakh Barabanki.
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Sh.Virendra Kumar Chaudhary, Lecturer Electrical Engineering, Government Girls polytechnic Lucknow.