

NSQF ALIGNED CURRICULUM

**DIPLOMA IN ELECTRONICS AND COMMUNICATION
ENGINEERING**

**PUNJAB STATE BOARD OF TECHNICAL EDUCATION
&
INDUSTRIAL TRAINING**



Developed By
Curriculum Development Center
National Institute of Technical Teachers Training & Research
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FOREWORD

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 of standard of life 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 cultures and environments together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the license-based closed economy to knowledge and market based open economy in the last few decades. In order to cope with the challenges of handling new technologies, 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 phenomenally 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 and field organizations. The initiatives being taken by the State Board of Technical Education, Punjab to revise the existing curricula of diploma programmes as per the needs of the industry and making them National Skill Qualification Framework (NSQF) compliant, are laudable.

In order to meet the requirements of 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 adopting 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 effective implementation of its curricula. Howsoever best the curriculum document is designed, if it 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 implementation of the curricula.

It is expected that the polytechnics 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 get the faculty members regularly trained and upskilled. So that it can infuse the much needed dynamism in the system. They are welcome to reach NITTTR Chandigarh whenever they want to train the faculty members and get the curricula revised.

Director
National Institute of Technical Teachers
Training & Research, Chandigarh

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Coordinator

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING

- 1) Name of the Programme : Diploma Programme in Electronics and Communication Engineering
- 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, Punjab
- 4) Intake : 40/60 (or as prescribed by the Board)
- 5) Pattern of the Programme : Semester Pattern
- 6) NSQF Level : Level - 5
- 7) Ratio between theory and Practice : 39 : 61
- 8) Industrial Training:
Six weeks of industrial training is included after IV semester during summer vacation
- 9) Ecology and Environment :
As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.
- 10) Energy Conservation:
An Energy Conservation Awareness Camp has been included in the curriculum to sensitize the students about significance and various aspects of energy conservation. Concepts of Energy Conservation have also been included in the subject of Environmental Studies.
- 11) Entrepreneurship Development:
An Entrepreneurial Awareness Camp and a full subject on Generic Skills and Entrepreneurship Development have been incorporated in the curriculum.

- 12) Camps on “Traffic Awareness and Road Safety” have been added in semester I & II under Student Centered Activities.
- 13) “Drugs Use and Abuse Awareness Camp” have been added in IIIrd Semester under Student Centered Activities.
- 14) Personality Development

A camp focusing on personality development of students has been incorporated in the curriculum.
- 15) Student Centred Activities:

A provision of 3-6 hrs 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, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities etc.
- 16) Minor and Major Project

Minor and Major Projects have 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.

2. EMPLOYMENT OPPORTUNITIES AND ACTIVITY PROFILE OF DIPLOMA HOLDERS IN TEXTILE TECHNOLOGY

An exercise, to have firsthand information about employment opportunities and activity profile of diploma engineers in the field of Electronics and Communication Engineering, was done by Curriculum Development Centre of National Institute of Technical Teachers' Training and Research, Chandigarh. The feedback from industries and other organizations has revealed that diploma holders in Electronics and Communication Engineering find employment in the following organizations:

(A) EMPLOYMENT OPPORTUNITIES

Various Departments/ organizations/boards and corporations

- 1) Tele-Communication Engineering and related Departments
- 2) AIR, Doordarshan,
- 3) Radar and Wireless,
- 4) Railways,
- 5) Defence Services, Para-military Forces
- 6) Civil Aviation
- 7) Defence Research and Development Organizations
- 8) Electricity Boards and Corporations etc.
- 9) Research and Development Deptt.
- 10) Maintenance Deptt.

Industry

- 11) Communication Industry manufacturing wireless mobile equipment for Defence and Paramilitary forces
- 12) PCB Design and Fabrication Industry
- 13) Consumer Electronics Industry
- 14) Electronic Components and Devices Manufacturing and Installation Organizations
- 15) Computer Assembling and Computer Peripheral Industry;
- 16) Computer Software Areas for Electronic Design and Semi Conductor Manufacturing Industry
- 17) Instrumentation and Control Industries
- 18) Internet Server Provides
- 19) Public Sector Undertakings (like BHEL,BEL, HAL, etc)
- 20) D.T.H component and Fabrication factory

- 21) Mobile Phone assembly Industries
- 22) Medical Electronics Industry
- 23) EPBX/ Telephone Exchange Manufacturing Industries
- 24) Computer Software Areas for Electronic Design and Semi Conductor Manufacturing Industry
- 25) Computer Assembling and Computer Peripheral Industry;
- 26) Automobile Industry
- 27) Automation and Control Industry (viz bottling plant, cement plant, automobile units, escalators etc.

Development/Testing Laboratories/Organizations

- 28) Electronics Service Centres
- 29) Opto Electronics (Medical & Comm.)
- 30) Computer Networking
- 31) Hospitals
- 32) Sales and Services of Electronic Gadgets from Small Scale Industries
- 33) Call Centres

Self-Employment

- Marketing and Sales (Distributors - whole sale and retailers)
- Service Sector(repair and Maintenance; job work)
- Cable laying and jointing DBs etc.
- Preparing Simulated Models
- Manufacturing Unit (e.g.- Bulb manufacturing, chalk manufacturing, circuit manufacturing units etc)

After first year, the NSQF Level – 3 pass out students have avenues to work as semi skilled employee. Similarly, after second year, the NSQF Level – 4 pass out students have wide scope to work as skilled employee in Electronics and Communication Engineering related industries.

After completing the diploma, students may find suitable jobs at the level of supervision in Electronics and Communication Engineering related industries.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING

Sr. No.	Learning Outcomes
1.	Communicate effectively in English in oral and written forms with others
2.	Apply basic principles of mathematics science to solve engineering problems
3.	Use computer and IT tools for creating document, making spread sheet and making presentation
4.	Prepare and interpret drawings of engineering components
5.	Prepare Simple jobs as per specifications
6.	Use electronic instruments to measure various engineering parameters
7.	Measure parameters of basic electrical engineering
8.	Use appropriate Practices for conservation prevention of environment pollution
9.	Perform testing, fault finding and trouble shooting of electrical and electronics circuits
10.	Assemble, test and troubleshoot electronic circuits consisting of passive and active components by applying appropriate testing and measurement techniques
11.	Design and troubleshoot basic communication systems
12.	Design and troubleshoot digital electronic circuits
13.	Design and troubleshoot analog and digital electronic circuits
14.	Use electrical machines and equipment
15.	Design and troubleshoot advanced communication systems
16.	Measure parameters of various power devices and industrial equipment
17.	Program microcontroller for embedded system design applications

18.	Fabricate PCBs and design the layout of various instruments and equipment for wiring/circuit development
19.	Plan and execute given task/project as a team member/leader Prepare detailed project proposal and report
20.	Use various digital audio-video transmission techniques and systems
21.	Demonstrate analog and digital transmission using optical fiber
22.	Troubleshoot different digital communication systems
23.	Program PLC using Ladder diagram and explore SCADA
24.	Describe basic concepts of Industry 4.0
25.	Troubleshoot basic medical electronic equipment
26.	Describe complete process involved in IC fabrication
27.	Develop and Simulate VHDL code for combinational and sequential logics.
28.	Measure parameters of various active and passive microwave devices and components
29.	Use various mobile communication systems and their multiple access techniques
30.	Manage resources effectively at the workplace
31.	Explore advanced concepts of Industry 4.0
32.	Solve real life problems by application of acquired knowledge and skills
33.	Explore interest and passion in areas other than professional stream

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English in oral and written forms with others	– English and Communication Skills
2.	Apply basic principles of mathematics science to solve engineering problems	– Applied Physics – Applied Chemistry – Applied Mathematics
3.	Use computer and IT tools for creating document, making spread sheet and making presentation	– Basics of Information Technology
4.	Prepare and interpret drawings of engineering components	– Engineering Drawing
5.	Prepare Simple jobs as per specifications	– General Workshop Practice
6.	Use electronic instruments to measure various engineering parameters	– Basic Electronics
7.	Measure parameters of basic electrical engineering	– Basic Electrical Engineering
8.	Use appropriate Practices for conservation prevention of environment pollution	– Environmental Studies
9.	Perform testing, fault finding and trouble shooting of electrical and electronics circuits	– Electrical & Electronics Workshop
10.	Assemble, test and troubleshoot electronic circuits consisting of passive and active components by applying appropriate testing and measurement techniques	– Electronic Instruments and Measurement
11.	Design and troubleshoot basic communication systems	– Principles of Communication Engineering
12.	Design and troubleshoot digital electronic circuits	– Digital Electronics
13.	Design and troubleshoot analog and digital electronic circuits	– Electronic Devices and Circuits
14.	Use electrical machines and equipment	– Electrical Machines
15.	Design and troubleshoot advanced communication systems	– Communication Systems

16.	Measure parameters of various power devices and industrial equipment	– Industrial Electronics
17.	Program microcontroller for embedded system design applications	– Microcontroller and Embedded Systems
18.	Fabricate PCBs and design the layout of various instruments and equipment for wiring/circuit development	– Electronics Design and Simulation Techniques
19.	Plan and execute given task/project as a team member/leader Prepare detailed project proposal and report	– Generic Skills and Entrepreneurship Development
20.	Use various digital audio-video transmission techniques and systems	– Audio Video Systems
21.	Demonstrate analog and digital transmission using optical fiber	– Optical Fiber Communication
22.	Troubleshoot different digital communication systems	– Digital Communication
23.	Program PLC using Ladder diagram and explore SCADA	– PLCs and SCADA
24.	Describe basic concepts of Industry 4.0	– Industry 4.0 (Part – I)
25.	Troubleshoot basic medical electronic equipment	– Medical Electronics
26.	Describe complete process involved in IC fabrication	– IC Fabrication
27.	Develop and Simulate VHDL code for combinational and sequential logics.	– VLSI System Design
28.	Measure parameters of various active and passive microwave devices and components	– Microwave Engineering
29.	Use various mobile communication systems and their multiple access techniques	– Wireless and Mobile Communication
30.	Manage resources effectively at the workplace	– Basics of Management
31.	Explore advanced concepts of Industry 4.0	– Industry 4.0 (Part – II)
32.	Solve real life problems by application of acquired knowledge and skills	– Minor and Major Project – Industrial Training
33.	Explore interest and passion in areas other than professional stream	– Open Elective

5. ABSTRACT OF THE CURRICULUM AREAS

a) Humanities and Social Science Courses

1. English and Communication Skills
2. Generic Skills and Entrepreneurship Development
3. Basics of Management
4. Environmental Studies

b) Basic/Applied Science Courses

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

c) Engineering Science Courses

8. Engineering Drawing
9. Basics of Information Technology
10. Basic Electronics
11. Basic Electrical Engineering
12. General Workshop Practice
13. Electrical and Electronics Workshop

d) Core Courses in Engineering/Technology

14. Electronic Instruments and Measurement
15. Principles of Communication Engineering
16. Digital Electronics
17. Electronic Devices and Circuits
18. Electrical Machines
19. Communication System
20. Industrial Electronics
21. Microcontrollers and Embedded System
22. Electronics Design and Simulation Techniques
23. Audio Video Systems
24. Optical Fiber Communication
25. Digital Communication
26. PLCs and SCADA

- 27. Industry 4.0 (Part – I)
- 28. VLSI System Design
- 29. Microwave Engineering
- 30. Wireless and Mobile Communication
- 31. Industry 4.0 (Part – II)

e) Electives

- 32. Program Electives
- 33. Open Electives

f) Project Work, Seminar and Industrial Training

- 34. Minor and Major Project
- 35. Industrial Training

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Hours per week in Various Semesters					
		I	II	III	IV	V	VI
1.	English and Communication Skills	5	5	-	-	-	-
2.	Applied Mathematics	4	3	-	-	-	-
3.	Applied Physics	5	4	-	-	-	-
4.	Applied Chemistry	5	-	-	-	-	-
5.	Basics of Information Technology	2	-	-	-	-	-
6.	Engineering Drawing	6	-	-	-	-	-
7.	General Workshop	4	4	-	-	-	-
8.	Basics Electronics	-	5	-	-	-	-
9.	Basic Electrical Engineering	-	5	-	-	-	-
10.	Environmental Studies	-	2	-	-	-	-
11.	Electrical & Electronics Workshop		6				
12.	Electronic Instruments and Measurement	-	-	5	-	-	-
13.	Principles of Communication Engineering	-	-	6	-	-	-
14.	Digital Electronics	-	-	5	-	-	-
15.	Electronic Devices and Circuits		-	5	-	-	
16.	Electrical Machines	-	-	5	-	-	-
17.	Open Elective (Online/Offline)		-	2			
18.	Generic Skills and Entrepreneurship Development	-	-	-	3	-	-
19.	Communication System	-	-	-	5	-	-
20.	Industrial Electronics	-	-	-	6	-	-
21.	Microcontrollers and Embedded System	-	-	-	7	-	-
22.	Electronics Design and Simulation Techniques		-	-	4	-	
23.	Audio Video Systems	-	-	-	-	6	-
24.	Optical Fiber Communication	-	-	-	-	6	-
25.	Digital Communication	-	-	-	-	6	-
26.	PLCs and SCADA		-	-	-	6	-
27.	Industry 4.0 (Part I and II)					2	2
28.	VLSI System Design	-	-	-	-	-	6
29.	Microwave and Radar Engineering	-	-	-	-	-	5
30.	Wireless and Mobile Communication	-	-	-	-	-	5
31.	Basics of Management	-	-	-	-	-	3
32.	Program Elective	-	-	-	-	3	-
33.	Minor / Major Project	-	-	-	6	-	10
34.	Student Centred Activities	4	1	7	4	6	4
Total		35	35	35	35	35	35

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN ELECTRONICS & COMMUNICATION ENGINEERING

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*English and Communication Skills – I	3	2	4	20	10	30	50	3	20	3	70	100
1.2	*Applied Mathematics - I	4	-	4	50	-	50	50	3	-	-	50	100
1.3	*Applied Physics – I	3	2	4	20	10	30	50	3	20	3	70	100
1.4	*Applied Chemistry	3	2	4	20	10	30	50	3	20	3	70	100
1.5	*Basics of Information Technology	-	2	1	-	40	40	-	-	60	3	60	100
1.6	*Engineering Drawing – I	-	6	3	-	50	50	50	3	-	-	50	100
1.7	+General Workshop – I		4	2	-	50	50	-	-	50	3	50	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp (I)		-	4	-	-	-	-	-	-	-	-	-	-
	Total	13	22	22	110	170	280	250	-	170	-	420	700

* Common course with other diploma programmes

+ Common course with diploma programmes in Computer Science & Engineering and Information Technology

SCA 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 other activities to promote experiential learning.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT								
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*English and Communication Skills - II	3	2	4	20	10	30	50	3	20	3	70	100
2.2	*Applied Mathematics – II	3	-	3	50	-	50	50	3	-	-	50	100
2.3	*Applied Physics – II	2	2	3	20	10	30	50	3	20	3	70	100
2.4	*Environmental Studies	2	-	2	50	-	50	50	3	-	-	50	100
2.5	Basic Electronics	3	2	4	20	10	30	50	3	20	3	70	100
2.6	Basic Electrical Engineering	3	2	4	20	10	30	50	3	20	3	70	100
2.7	Electrical & Electronics Workshop	-	6	3	-	50	50	-	-	50	3	50	100
2.8	+General Workshop – II		4	2	-	50	50	-	-	50	3	50	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp (II)		-	1	-	-	-	-	-	-	-	-	-	-
Total		16	19	25	180	140	320	300	-	180	-	480	800

* Common Course with other diploma programmes

+ Common course with diploma programmes in Computer Science & Engineering and Information Technology

SCA 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 other activities to promote experiential learning.

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits Cr	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT								
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Electronic Instruments and Measurement	3	2	4	20	10	30	50	3	20	3	70	100
3.2	Principles of Communication Engineering	2	4	4	20	10	30	50	3	20	3	70	100
3.3	**Digital Electronics	3	2	4	20	10	30	50	3	20	3	70	100
3.4	Electronic Devices and Circuits	3	2	4	20	10	30	50	3	20	3	70	100
3.5	Electrical Machines	3	2	4	20	10	30	50	3	20	3	70	100
3.6	Open Elective (Offline/MOOCs)	2	-	2	50	-	50	50	3	-	-	50	100
# Student Centred Activities (SCA) including Energy Conservation Awareness Camp ; Drug Use and Abuse Awareness Camp		-	7	-	-	-	-	-	-	-	-	-	-
Total		16	19	22	150	50	200	300	-	100	-	400	700

** Common with Computer Science & Engineering and Information Technology

SCA 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 other activities to promote experiential learning.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		L/T	P		Cr	INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT				
				Th		Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Generic Skills and Entrepreneurship Development	3	-	3	50	-	50	50	3	-	-	50	100
4.2	Communication Systems	3	2	4	20	10	30	50	3	20	3	70	100
4.3	Industrial Electronics	2	4	4	20	10	30	50	3	20	3	70	100
4.4	Microcontrollers and Embedded System	3	4	5	20	10	30	50	3	20	3	70	100
4.5	Electronics Design and Simulation Techniques	-	4	2	-	50	50	-	-	50	3	50	100
4.6	Minor Project	-	6	3	-	50	50	-	-	50	3	50	100
# Student Centred Activities including Entrepreneurial Awareness camp			4	-	-	-	-	-	-	-	-	-	-
Total		11	24	21	110	130	240	200	-	160	-	360	600

* Common Course with other Diploma Programmes

SCA 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 other activities to promote experiential learning.

Industrial Training - After examination of 4th Semester, the students shall go for training in a relevant industry/field organization for a minimum period of 6 weeks and shall prepare a diary. It shall be evaluated during 5th semester by his/her teacher for 50 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer in-charge – training in the presence of one representative from training organization.

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		L/T	P		Cr	INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT				
				Th		Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
	Industrial Training during vacation after 4 th Semester	-	-	2	-	50	50	-	-	50	3	50	100
5.1	Audio Video Systems	2	4	4	20	10	30	50	3	20	3	70	100
5.2	Optical Fiber Communication	2	4	4	20	10	30	50	3	20	3	70	100
5.3	Digital Communication	2	4	4	20	10	30	50	3	20	3	70	100
5.4	PLCs and SCADA	2	4	4	20	10	30	50	3	20	3	70	100
5.5	Industry 4.0 (Part-I)	2	-	2	50	-	50	50	3	-	-	50	100
5.6	Program Elective	3	-	3	50	-	50	50	3	-	-	50	100
# Student Centred Activities (SCA) including Personality Development Camp		-	6	-	-	-	-	-	-	-	-	-	-
Total		13	22	23	180	90	270	300	-	130	-	430	700

SCA 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 other activities to promote experiential learning.

Program Elective: Any one of the following:

1) Medical Electronics

2) IC Fabrication

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits Cr	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	VLSI System Design	2	4	4	20	10	30	50	3	20	3	70	100
6.2	Microwave Engineering	3	2	4	20	10	30	50	3	20	3	70	100
6.3	Wireless and Mobile Communication	3	2	4	20	10	30	50	3	20	3	70	100
6.4	*Basics of Management	3	-	3	50	-	50	50	3	-	-	50	100
6.5	Industry 4.0 (Part-II)	2	-	2	50	-	50	50	3	-	-	50	100
6.6	Major Project	-	10	5	-	50	50	-	-	50	3	50	100
# Student Centred Activities (SCA)		-	4	-	-	-	-	-	-	-	-	-	-
Total		13	22	22	160	80	240	250	-	110	-	360	600

* Common Course with other Diploma Programmes

SCA 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 other activities to promote experiential learning.

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L	P
3	2

RATIONALE

Communication skills play 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.

LEARNING OUTCOMES

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

- Pronounce properly.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Converse logically.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Basics of Communication | (12 hrs) |
| 1.1 | Definition and process of communication | |
| 1.2 | Introduction to types of communication - formal and informal, oral and written, verbal and non-verbal | |
| 1.3 | Objectives of communication | |
| 1.4 | Essentials of communication | |
| 1.5 | Introduction to channels of communication - formal (upward, downward, diagonal, horizontal), informal (grapevine, consensus) | |
| 1.6 | Barriers to communication | |
| 2. | Functional Grammar and Vocabulary | (12 hrs) |
| 2.1 | Parts of speech | |
| 2.2 | Article | |
| 2.3 | Tenses | |
| 2.4 | Subject verb agreement sentences | |
| 2.5 | Active and passive voice | |
| 2.6 | Synonyms and antonyms | |
| 2.7 | Pair of words | |
| 2.8 | Correction of incorrect sentences | |

3. Listening (04 hrs)
- 3.1 Meaning of listening
 - 3.2 Listening and hearing
 - 3.3 Importance of listening
 - 3.4 Active listening – Meaning and strategies
 - 3.5 Methods to improve listening skills
4. Speaking (03 hrs)
- 4.1 Importance
 - 4.2 Methods to improve speaking
5. Reading (12 hrs)
- 5.1 Meaning
 - 5.2 Techniques of reading: skimming, scanning, intensive and extensive reading
 - 5.3 Comprehension, vocabulary enrichment and grammar exercises based on following readings:
- Section - I
- My Struggle for an Education – Booker T. Washington
 - Abraham Lincoln's letter to his son's headmaster – Abraham Lincoln
 - Gateman's Gift – R.K Narayan
 - The Selfish Giant - Oscar Wilde
- Section - II
- Say Not, the Struggle Nought Availeth – A H Clough
 - Stopping by Woods on a Snowy Evening – Robert Frost
 - Where the Mind is Without Fear – Rabindranath Tagore
6. Writing (02 hrs)
- 6.1 Significance and effectiveness of writing
 - 6.2 Paragraph writing – Word choice, sentence formation and construction of paragraph.

LIST OF PRACTICALS

1. Self and peer introduction
2. Newspaper reading
3. Just a Minute session – extempore
4. Situational conversation and role play
5. Language learning using open source software.

6. Greetings for different occasions
7. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, “Communicating Effectively in English, Book-I”, Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, “Developing Communication Skills (2nd Edition)”, Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, “Oxford Practice Grammar”, Oxford University Press, London
4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	12	12
3	04	6
4	03	3
5	12	15
6	02	2
Total	45	50

1.2 APPLIED MATHEMATICS - I

L	P
4	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like binomial theorem, partial fractions, etc. for solving complex engineering problems with exact solutions in a way which involve less computational task. The analytical capabilities will enable the students to solve problems in engineering field.

LEARNING OUTCOMES

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

- Apply Complex Number and its representation for two dimensional designing and related calculations.
- Apply the basic concepts of permutation and combination to find out various ways or arrangements possible for a particular problem.
- Apply binomial theorem to find approximate value of certain expressions and extracting roots of certain expressions.
- Apply basics concepts of partial fractions to simplify the concept of rational expression.
- Solve engineering problems that are in matrix format by applying the basic understanding of matrices and their properties,
- Solve problems related to height, distance, elevation by making use of trigonometry.
- Write the equation of straight line and circle by using coordinate geometry.
- Optimize the utilization of resources by applying concepts of linear programming.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Algebra | (20 hrs) |
| 1.1 | Complex Numbers: Complex number, representation, modulus and amplitude. | |
| 1.2 | Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors). | |

- 1.3 Meaning of n_{Pr} & n_{Cr} (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof), first and second binomial approximation with applications to engineering problems.
- 1.4 Introduction to Matrices and Determinants – Addition, subtraction and multiplication (upto 3×3 matrices), Determinants, simple properties, Crammer Rule.
2. Trigonometry (15 hrs)
 - 2.1 Introduction to T ratios, T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T-Ratios of multiple angles, sub-multiple angles ($2A$, $3A$, $A/2$).
 - 2.2 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.
3. Co-ordinate Geometry (18 hrs)
 - 3.1 Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to Polar coordinates and vice-versa
 - 3.2 Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), inter section of two straight lines, concurrency of lines, angle between straight lines.
 - 3.3 General equation of a circle and its characteristics. To find the equation of a circle, given:
 - * Centre and radius
 - * Three points lying on it
 - * Coordinates of end points of a diameter
4. Operations Research (7 hrs)
 - 4.1 Linear Programming Problems formulations.
 - 4.2 Graphical Method

INSTRUCTIONAL STATREGY

Basic of algebra, trigonometry, coordinate geometry, operations research can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students.

RECOMMENDED BOOKS

1. Grewal, BS, “Elementary Engineering Mathematics”, Khanna Publishers, New Delhi
2. Sabharwal, SS & Dr Sunita Jain, “Applied Mathematics, Vol. I & II”, Eagle Parkashan, Jalandhar
3. Sastry, SS, “Engineering Mathematics, Vol I & II”, Prentice Hall of India Pvt. Ltd.,
4. Pal, Srimanta and Subodh C. Bhunia, “Engineering Mathematics”, Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	20	16
2.	15	12
3.	18	16
4	7	06
Total	60	50

1.3 APPLIED PHYSICS – I

L	P
3	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in 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 will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

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

LEARNING OUTCOMES

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

- Select units of various physical quantities for use in engineering solutions.
- Represent physical quantities as scalar and vector.
- Use the concepts of force and motion to solve problems.
- Solve problems related to friction, work, power and energy,
- Comprehend properties of matter.
- Comprehend modes of heat transfer.
- Make measurements with accuracy.

DETAILED CONTENTS

1. Units and Dimensions (9 hrs)
 - 1.1 Physical quantities Units - fundamental and derived units, systems of units (FPS, CGS and SI units)
 - 1.2 Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, stress, strain)
 - 1.3 Principle of homogeneity of dimensions
 - 1.4 Dimensional equations and their applications, conversion of units from one system to another for density, force, pressure, work, power, velocity and acceleration. Checking of dimensional equations
 - 1.5 Limitations of dimensional analysis
2. Force and Motion (10 hrs)
 - 2.1 Scalar and vector quantities – examples, representation of vector, types of vectors

- 2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
 - 2.3 Resolution of Vectors
 - 2.4 Force, Momentum, Statement of Conservation of linear momentum, its applications
 - 2.5 Impulse and its Applications
 - 2.6 Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
 - 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (Only Formula), Angular momentum and torque (definition only)
 - 2.8 Concept of centripetal and centrifugal forces and their applications with examples such as banking of roads
3. Work, Power and Energy (8 hrs)
- 3.1 Work: and its units, examples of zero work, positive work and negative work
 - 3.2 Friction: concept, types, laws of limiting friction
 - 3.3 Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation
 - 3.4 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
 - 3.5 Power and its units, calculation of power in numerical problems
4. Properties of Matter (9 hrs)
- 4.1 Elasticity: definition of stress and strain, Moduli of elasticity (Only definition, No derivation) , Hooke's law, significance of stress strain curve
 - 4.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure
 - 4.3 Surface tension: concept, its units, angle of contact, applications of surface tension, effect of temperature on surface tension
 - 4.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law
5. Thermometry (9 hrs)
- 5.1 Difference between heat and temperature
 - 5.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 5.3 Different scales of temperature and their relationship
 - 5.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
 - 5.5 Concept of Co-efficient of thermal conductivity

LIST OF PRACTICALS (to perform minimum 8 experiments)

1. To find volume of solid sphere using a vernier caliper.
2. To find internal diameter and depth of a beaker using a vernier caliper and hence find its volume.
3. To find the diameter of wire using a screw gauge
4. To determine the thickness of glass strip using a spherometer
5. To verify parallelogram law of forces
6. To study conservation of energy of a ball or cylinder rolling down an inclined plane.
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 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 can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi
2. "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw Hill, Delhi
3. Verma, HC, "Concepts in Physics Vol. I & II", Bharti Bhawan Ltd. New Delhi
4. "Comprehensive Practical Physics, Vol, I & II", JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
5. Naik, PV, "Engineering Physics", Pearson Education Pvt. Ltd, New Delhi
6. Banwait, RA & R, Dogra, "Applied Physics I & II", Eagle Parkashan, Jalandhar
7. Bhattacharya, DK & Poonam Tandan, "Engineering Physics", Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	9	10
2.	10	12
3.	8	8
4.	9	10
5.	9	10
Total	45	50

1.4 APPLIED CHEMISTRY

L P

3 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 materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding diploma holders to develop scientific temper and appreciate importance of chemistry. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

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

- Interpret both qualitative and quantitative aspects of simple chemical substances.
- Substantiate the laws and principles on which structure of atom is established.
- Understand types of bonds in chemical substance and their influence on the properties of chemical substances.
- Prepare solution of required concentrations.
- Understand qualitatively and quantitatively pH and buffer solutions.
- Significance of pH and buffer solutions and their industrial applications (in the process such as electrolysis, electrochemical machining of materials etc).
- Explain cause and factors adversely affecting natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic, agricultural and industrial applications.
- Appreciate and practice the water conservation techniques.
- Identify and classify the substance based on the electric behavior.
- Realize the laws/principles efficiently used in development of electrochemical cells towards the greener energy.
- Identify most efficient fuel for the engine and engineering applications.
- Understand the elementary idea of polymers and plastics
- Distinguish different type of plastics and their applications.

DETAILED CONTENTS

1. Basic Concept of Chemistry (2 hrs)
 - 1.1 Symbols of elements and valency, writing of chemical formulae of simple compounds.
 - 1.2 Calculation of molecular masses of CaCO_3 , NaCl , CuSO_4 , NaOH , Ca(OH)_2 , H_2SO_4 , $\text{C}_2\text{H}_2\text{O}_4$. (Atomic mass of elements should be provided)
2. Atomic Structure and Chemical Bonding (8 hrs)
 - 2.1 Bohr's model of atom (qualitative treatment only).
 - 2.2 Atomic number, atomic mass number isotopes and isobars.
 - 2.3 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
 - 2.4 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 with atomic number greater than 30 are excluded).
 - 2.5 Chemical bonding and cause of bonding and types of chemical bonding; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H_2 , O_2 , N_2 and CH_4 Metallic bonding.
3. Solutions (05 hrs)
 - 3.1 Definition of solution, solute and solvent with examples
 - 3.2 Methods to express the concentration of solution- molarity (M) and molality (m), mass percentage, volume percentage and mole fraction and related simple numericals.
 - 3.3 Arrhenius concept of acids and bases. pH of solution, simple numericals on pH and industrial applications of pH.
 - 3.4 Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions.
4. Water (10 hrs)
 - 4.1 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 numericals.
 - 4.2 Disadvantages caused by the use of hard water in domestic industry and boiler feed water.
 - 4.3 Removal of hardness -Permutit process and Ion-exchange process.
 - 4.4 Drinking water and characteristics of drinking water.
 - 4.5 Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea).

5. Electro Chemistry (6 hrs)
 - 5.1 Electronic concept of oxidation, reduction and redox reactions
 - 5.2 Definition of terms: electrolytes, non-electrolytes with suitable examples
 - 5.3 Faradays laws of electrolysis and simple numerical problems.
 - 5.4 Industrial Application of Electrolysis – Electroplating.
 - 5.5 Application of redox reactions in electrochemical cells (qualitative idea only excluding reactions) - commercial dry cell (Primary) and elementary idea of secondary cell (Only lead storage battery)

6. Chemistry of Fuels and Lubricants (12 hrs)
 - 6.1. Definition of fuel, classification of fuels (primary and secondary), characteristics of good fuel.
 - 6.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
 - 6.3 Coal - proximate analysis of coal
 - 6.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
 - 6.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas. (preparation/manufacture excluded)
 - 6.6 Definition of Lubricant and characteristics of good lubricant
 - 6.7 Classification of lubricants –liquid lubricants, solid lubricants, semi-solid lubricants with examples
 - 6.8 Properties of lubricant: Physical properties –viscosity and viscosity index, cloud point and pour point, flash point and fire point, oiliness. Chemical properties- Total Acid Value or Number (TAV or TAN), carbon residue, saponification value.

7. Polymers and Plastics (02 hrs)
 - 7.1 Definition of polymer, monomer and degree of polymerization
 - 7.2 Brief introduction of plastics - thermo plastics and thermo setting plastics with suitable examples (PVC, PS, PTFE, Nylon 6, Nylon 66, bakelite) distinction between thermo and thermo setting plastics
 - 7.3 Applications of polymers in industry and daily life
 - 7.4 Introduction to nano materials and nano technology

LIST OF PRACTICALS

1. Preparation of standard solution of oxalic acid.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.

3. To determine TDS in given sample of water.
4. To prepare Mohr's salt from ferrous sulfate and ammonium sulfate.
5. Determination of pH of given solution using pH meter.
6. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution.
7. Gravimetric estimation of moisture in the given coal sample (proximate analysis).
8. Gravimetric estimation of ash content in the given coal sample (proximate analysis).
9. Determination of viscosity of given liquid using Redwood viscometers
10. To construct simple Daniel cell and measure its e.m.f. using voltmeter.
11. To estimate hardness of water using EDTA method.

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Kuricose, J.C. and J. Rajaram, "Chemistry in Engineering", Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Jain, P.C. & Monika Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company, New Delhi.
3. Ahuja, S. C. and G. H. Hugar, "Eagle's Applied Chemistry (I and II)", Eagle Prakashan, Jalandhar.
4. Rao, C N R, "Understanding Chemistry", Universities Press (India) Pvt Ltd., 2011
5. Chopra, H. K. & A. Parmar, "Engineering Chemistry – A Text Book", Narosa Publishing House, New Delhi.
6. Pandey, Dr. Himanshu, "Engineering Chemistry", Goel Publishing House, Meerut, India.

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (Out of 50)
1.	02	03
2.	08	08
3.	05	06
4.	10	12
5.	06	06
6.	12	12
7.	02	03
Total	45	50

1.5 BASICS OF INFORMATION TECHNOLOGY

L	P
-	2

RATIONALE

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

LEARNING OUTCOMES

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

- Identify computer hardware components, network components and peripherals.
- Install application and utility software.
- Use word processing software to prepare document.
- Use spreadsheet software to create workbook and automate calculation.
- Use presentation software to create interactive presentation.
- Browse information on the Web.

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.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

Information Technology concept and scope, applications of IT.

2. Computer Hardware:

Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, tracks and sectors, optical disk (CD , DVD & Blue Ray Disk.), USB/Flash Drive, HDD, SSD

3. Software Concepts and Programming:

System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Application software, Features of OPEN OFFICE/MS OFFICE(MS word, Excel, PowerPoint).
Flow chart using algorithm development, Input Output statement, Control structures

4. Internet Concepts:

Basics of Networking – LAN, WAN, PAN, MAN, and sharing of printers and other resources, Concept of IP addresses, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, identify its basic hardware components, network components and peripherals. List their functions .
2. Installation of various application software and utility software.
3. Installation of I/O devices like scanner, printer and plotter.
4. Practice on various features/functions of Windows Operating System..

Word Processing (MS Word/Open Office Writer/Libre Office Writer)

5. Creating/opening, saving and printing a document
6. Editing and formatting a document
7. Setting paragraph and page margins.
8. Adding header, footer and page numbering
9. Creating, inserting and formatting a table.
10. Spell checker, inserting date, time, special symbols, importing graphic images, drawing tools.

Spread Sheet Processing (MS Excel/Open Office Calc/Libre Office Calc)

11. Creating/opening, saving and printing a worksheet.
12. Editing and formatting of worksheets including changing colour, size, font, alignment of text and cell formatting.
13. Using statistical functions like sum, avg, min, max, if, count and countif, lookup.
14. Creating and formatting a chart, Using charts to analyse data. Use of filters.

Presentation Software (MS Power Point/Open Office Impress/Libre Office Impress)

15. Creating, saving, opening and printing a presentation.
16. Different views of a slide.
17. Using slide layout and template.
18. Editing and formatting slides by adding titles, subtitles, text, background, watermark, table, charts, images and sound.
19. Viewing the slide show with slide transition, animation effect, timing and order.

Programming

20. Printing of name 100 times using loop statement.

Internet and its Applications

21. Creating an e mail account. Sending and receiving e-mail.
22. Browsing and down loading of information from internet.
23. Surfing different websites like institute website, State Board PSBTE website, DTE website, NITTTR, Chandigarh website, AICTE website, various search engines like google, bing etc.

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 in addition to working on internet. The student should be made capable of working on computers independently.

RECOMMENDED BOOKS

1. Arora, Vipin, “Computer Fundamentals and Information Technology”, Eagle Parkashan, Jalandhar
2. Sinha, PK, “Computer Fundamentals”, BPB Publication, New Delhi
3. Rajaraman V, “Fundamentals of Computer”, Prentice Hall of India Pvt. Ltd., New Delhi
4. Saxena, Sanjay, “MS Office for Everyone”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Leon and Leon, “Fundamentals of Information Technology”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

1.6 ENGINEERING DRAWING – I

L P
- 6

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 16 sheets to be prepared and at least 3 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
- 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.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

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 instruments.
 - 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 ratio 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 (1st and 3rd angle)
 - 4.3.1. Line parallel to both the planes
 - 4.3.2. Line perpendicular to any one of the reference plane
 - 4.3.3. Line inclined to any one of the reference plane.

- 4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only
- 4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)
- 4.6 Identification of surfaces
- 5. Sections (02 sheets)
 - 5.1 Importance and salient features
 - 5.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
 - 5.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
 - 5.4 Orthographic sectional views of different objects.
- 6. Isometric Views (02 sheets)
 - 6.1 Fundamentals of isometric projections and isometric scale.
 - 6.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
- 7. Common Symbols and Conventions used in Engineering (02 sheets)
 - 7.1 Civil Engineering sanitary fitting symbols
 - 7.2 Electrical fitting symbols for domestic interior installations
- *8. Introduction to Computer Aided Drafting (03 sheets)

Basic introduction and operational instructions of various commands in Computer Aided Drafting. At least three 2 D drawings using Computer Aided Drafting of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

*** Computer aided 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 should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

RECOMMENDED BOOKS

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

1.7 GENERAL WORKSHOP– I

L	P
-	4

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practical. General workshop practical included in the curriculum in order to provide hands-on practical knowledge of different tools and basic manufacturing processes. Basic knowledge of workshop technology and practical in various workshops develop the attitude of team working, safety awareness and development of right attitude. This subject provides miniature industrial environment in the educational institute.

LEARNING OUTCOMES

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

- Identify shop wise tools and equipment, their types, specifications and use with proficiency.
- Identify different types of materials, their uses and to maintain tools, equipment etc.
- Use and take measurements with the help of basic measuring tools/instrument.
- Select proper tools for a particular operation and use hand tools in different workshops with predefined outcome.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same according to drawing.
- Operate various tools and equipment in different workshops with predefined outcome, performance, standards.
- Follow the safety procedures and precautionary measures in different workshop with zero accidents.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop uniform 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 workshops will be explained for conduct of practical. The students should prepare sketches of various tools/jobs sequence of operations etc. in their practical notebook.

The following shops are included in the syllabus:

1. Welding Shop –I
2. Fitting Shop –I
3. Sheet Metal Shop –I
4. Electric Shop-I
5. Carpentry Shop –I
6. Electronic Shop –I

1. WELDING SHOP –I

- 1.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and importance of welding as compared to other material joining processes. Classification of welding processes. Specifications and type of welding machines, welding parameters, welding methods, welding joints and welding positions. Classification and coding of electrodes and functions of electrode coating ingredients.
- 1.2 Demonstration of hand tools, arc welding machines, equipment and materials to be welded.
- 1.3 Jobs to be prepared:
 - Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat) and Practice of depositing beads at different current levels. (Minimum 4 beads on M.S. flat at four different setting of current level).
 - Job II Making a lap joint using arc welding (SMAW) on MS Flat.

2. FITTING SHOP –I

- 2.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, functions, classification, specification and use of various types of holding, cutting, marking and measuring tools used in fitting shop like-Bench vice, V block, C clamp, Ball peen hammer, scriber, punches, files, hacksaw, surface plate, try square, calipers, steel rule, Vernier calliper, Micrometre and Vernier height gauge etc. Identification of materials like-Iron, Copper, Stainless Steel, Aluminium etc.), Identification of various steel sections like-flat, angle, channel, bar etc.). Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).
- 2.2 Demonstration of various types of holding, cutting, marking and measuring tools used in fitting shop.
- 2.3 Jobs to be prepared:
 - Job I To make a rectangular job by performing the operations: Sawing, Marking, filing on MS work piece (75 x 50 x 6 mm) by making sides at 90 degree and surface flatness at 180 degrees and to maintain dimensions within an accuracy of ± 0.25 mm.

Job II To Make 'V' type cut-out profile from a square piece of MS flat using hand hacksaw, filing, marking and measuring operations.

3. SHEET METAL SHOP – I

- 3.1. Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and functions of various types of tools used in sheet metal shop: - snips, hand shearing, measuring tools, marking tools, striking tools and bending tools including types of stakes. Introduction and importance to different types of joints and fasteners used in sheet metal work. Introduction and purpose of different metals used in sheet-metal work-black iron, galvanized iron, aluminium and stainless steel. Introduction of different types of Rivets, types of riveted joints, advantages, disadvantages and applications.
- 3.2 Demonstration of various types of holding, cutting, marking and bending tools used in fitting shop. demonstration of various raw materials used in sheet metal shop e.g. black-iron sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
- 3.3 Jobs to be prepared:
 - Job I Shearing and bending practice on a sheet using hand shears/snips and stakes.
 - Job II To fabricate different types of sheet metal joint such as lap joint-single seam/double seam.

4. ELECTRIC SHOP - I

- 4.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, functions and specifications of different types of tools, wires, cables, switches, fuses, cleats, clamps, allied items, and accessories used in Electric shop. Introduction to battery charger and its functioning. Introduction to common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Introduction to lead acid battery and nickel cadmium battery.
- 4.2 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. Demonstration of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of lead acid battery and nickel cadmium battery.
- 4.3 Job Practice:
 - Job I Identification of phase, neutral, earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Practice in making series and parallel circuit. Make one lamp control by one switch circuit.

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

5. CARPENTRY SHOP – I

5.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to wood, timber their properties, uses & defects and their joints. Seasoning of wood and its advantages. Introduction, specifications and function of various types of tools used in carpentry (such as different types of Saws, C-Clamp, Chisels, Carpenter's vice, Mallets, Marking gauges, Scriber, Try-square, Steel tape, Wooden plane, Metallic Jack plane, Rulers) by segregating as cutting tools, supporting tools, holding tools, measuring tools etc. Types of wooden joints. Techniques/method of sharpening of jack plane cutter/blade.

5.2 Demonstration of wood/timber, seasoning, various types of tools used in carpentry shop. Types of wooden joints.

5.3 Jobs to be Prepared:

Job 1 To make a rectangular wooden piece involving operations like-planing, marking, sawing and measuring.

Job II Iron jack plane blade/cutter sharpening and Chisel sharpening practice.

Job III To make a Half Lap Joint (cross, L or T shape – any one)

6. ELECTRONIC SHOP – I

6.1 Safety precautions of concerned shop and use of personal protective equipment (PPE), Difference between electrical and electronic devices, Tools used in electronics workshop - Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Snipper, Crimping tool, different types of Screw Drivers, L-Keys, Soldering Iron, Files, multimeter (analog and digital)

6.2 Demonstrate the jointing methods. mounting and dismantling as well as uses of the items mentioned below:

Various tools used in electronics shop. Various types of single, multi-cored insulated screened power, audio video, co-axial, general purpose wires/cables. Various types of fuses (slow acting, fast acting, thermal fuse and glass fuse). Various switches

6.3 Job Practice

- | | |
|---------|--|
| Job I | To make perfect solder joints and exposure to modern soldering and re soldering process. |
| Job II | To make soldering on PCBs and to remove components/wires by de-soldering. |
| Job III | Cut, strip, connect/solder/crimp different kinds of wires/cables (including coaxial and shielded cable) to different types of power/general purpose/ audio video/ telephone plugs, sockets jacks, terminal, binding, posts, terminal strips, connectors. |

Note:

1. Workshop instructors will guide and help the students throughout the practical class in order to explain and complete the job according to syllabus and for providing necessary facilities to the students during performance of practical by observing the safety precautions
2. The Workshop Superintendent or Foreman Instructor or Instructor will demonstrate and deliver the theoretical instructions with regard to introduction, functions, classification and specification of tools, instruments, equipment, apparatus etc. of all the topics covered in the syllabus of workshops.
3. The Workshop Superintendent or Foreman Instructor will also conduct the mid-term test and final practical exam of this subject.

RECOMMENDED BOOKS

1. Singh, Swaran, “Workshop Practice”, S.K. Kataria & Sons, Engineering Books New Delhi.
2. Bawa, HS, “Workshop Practice”, Tata McGraw Hill, New Delhi.
3. Choudhary, SK Hajra, and AK Choudhary, “Workshop Technology I, II, III”, Media Promoters and Publishers Pvt. Ltd. Mumbai.
4. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
5. Raghuwanshi, B.S., “Workshop Technology”, Dhanpat Rai and Co., New Delhi.

TRAFFIC AWARENESS & ROAD SAFETY CAMP (I)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety. By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Road safety Scenario
2. School bus and traffic management
3. Awareness of Traffic Signs
4. Speeding Limit
5. Always Wear your Shields
6. Overtaking
7. Awareness through Hoardings
8. Walking & Safe cycling

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L	P
3	2

RATIONALE

Communication skills play 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.

LEARNING OUTCOMES

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

- Make proper oral presentations.
- Speak confidently.
- Debate properly.
- Write accurate official/business letters.
- Respond to telephone calls effectively.
- Overcome communication barriers.

DETAILED CONTENTS

1. Functional Grammar and Vocabulary (12 hrs)

Theory and Practical exercises on following:

- 1.1 One word substitution
- 1.2 Functional Grammar and Vocabulary
- 1.3 Prefixes and Suffixes
- 1.4 Punctuation
- 1.5 Narration
- 1.6 Idioms and Phrases

2. Reading (9 hrs)

Comprehension, Vocabulary enrichment and grammar exercises based on the following readings:

Section-I

- The Last Leaf - O' Henry
- Sparrows - K A Abbas
- The Postmaster - Rabindra Nath Tagore

Section-II

- Night of the Scorpion - Nissim Ezekiel
- All the World is a Stage - William Shakespeare
- Success – Emily Dickenson
- Daffodils – William Wordsworth

3. Writing (24 hrs)

- 3.1 Writing Resume and Cover letter
- 3.2 Correspondence: Business and Official
- 3.3 Report Writing – Introduction and features of good report.
- 3.4 Press Release
- 3.5 Memos and Circulars
- 3.6 Notices (lost, found, and auction)
- 3.7 Agenda and Minutes of Meetings
- 3.8 Filling-up different forms such as bank form and on-line form for placement etc.
- 3.9 Precis Writing
- 3.10 E mail writing

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Debate
4. Manners and Etiquette
5. Power point presentation
6. Telephonic conversation: General etiquette for making and receiving calls.
7. Mock interviews

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, “Communicating Effectively in English, Book-I”, Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, “Developing Communication Skills (2nd Edition)”, Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, “Oxford Practice Grammar”, Oxford University Press, London

4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	9	12
3	24	26
Total	45	50

2.2 APPLIED MATHEMATICS – II

L P
3 -

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of differential calculus, integral calculus and differential equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Apply differential calculus to solve max/min and related rate measure problems.
- Apply concepts of definite integrals to calculate the area of a curve bounded by axes.
- Evaluate complex integrals in a simpler way by applying definite integral.
- Solve engineering problems by making use of ordinary differential equations.

DETAILED CONTENTS

1. Differential Calculus (18 hrs)
 - 1.1 Definition of function; Introduction to limit and continuity (definition only).
 - 1.2 Standard differentiation of algebraic, trigonometric, inverse trigonometric functions, logarithmic function and exponential function.
 - 1.3 Differentiation of sum, product and quotient of functions, Differentiation of function of a function, differentiation of implicit functions and parametric functions.
 - 1.4 Logarithmic differentiation and successive differentiation (excluding nth order).
 - 1.5 Application of differential calculus in:
 - (a) Rate Measures
 - (b) Maxima and minima (single variable functions) using second order derivative only
 - (c) Equation of tangent and normal to a curve (for explicit functions only)

2. Integral Calculus (22 hrs)
- 2.1 Indefinite integrals, Integration as inverse operation of differentiation with simple examples.
- 2.2 Standard integrals and related simple problems
- 2.3 Simple integration by substitution, by parts and by partial fractions (for linear factors only)
- 2.4 Evaluation of definite integrals (simple problems)
 Evaluation of $\int_0^{\pi/2} \sin^n x \, dx$, $\int_0^{\pi/2} \cos^n x \, dx$, $\int_0^{\pi/2} \sin^m x \cos^n x \, dx$
 using formulae without proof (m and n being positive integers only).
- 2.5 Applications of integration for evaluation of area bounded by a curve and axes (Simple problems).
3. Differential Equations (5 hrs)
- 3.1 Definition, order, degree of ordinary differential equations.
- 3.2 Formation of differential equation (up to 2nd order). Solution of Differential equations with Variable separation and Linear Differential equations.

INSTRUCTIONAL STATREGY

Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students.

RECOMMENDED BOOKS

1. Grewal, BS, "Elementary Engineering Mathematics", Khanna Publishers, New Delhi
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Sabharwal, SS & Dr Sunita Jain, "Applied Mathematics, Vol. I & II", Eagle Parkashan, Jalandhar

4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi
5. Sastry, SS, “Engineering Mathematics, Vol I & II”, Prentice Hall of India Pvt. Ltd.,
6. Pal, Srimanta and Subodh C. Bhunia, “Engineering Mathematics”, Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	18	20
2	22	25
3	5	05
Total	45	50

2.3 APPLIED PHYSICS – II

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology

LEARNING OUTCOMES

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

- Apply the concept of wave motion
- Illustrate laws of reflection and refraction of light.
- Comprehend the phenomenon related to electrostatics
- Comprehend the terms and laws related to electricity and magnetism.
- Make use of laser for engineering applications.

DETAILED CONTENTS

1. Wave motion and its Applications (6 hrs)
 - 1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application
 - 1.2 Free, forced and resonant vibrations with examples
 - 1.3 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
 - 1.4 Ultrasonics – Introduction and applications.

2. Optics (6 hrs)
 - 2.1 Laws of reflection and refraction, refractive index, lens formula for thin lenses, power of lens, magnification
 - 2.2 Total internal reflection and its applications, Critical angle and conditions for total internal reflection
 - 2.3 Simple and compound microscope, astronomical telescope in normal adjustment, magnifying power (Only formula).

3. Electrostatics (6 hrs)
 - 3.1 Coulombs law, unit of charge,
 - 3.2 Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference
 - 3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor (No derivation), Series and parallel combination of capacitors (numericals)
 - 3.4 Dielectric and its effect on capacitance, dielectric break down

4. Electricity and Magnetism (9 hrs)
 - 4.1 Electric Current and its Unit, Direct and alternating current,
 - 4.2 Resistance and its Units, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Superconductivity (concept only)
 - 4.3 Ohm's law and its verification
 - 4.4 Kirchhoff's laws, Wheatstone bridge principle
 - 4.5 Heating effect of current, Electric power, Electric energy and its units (related numerical problems)
 - 4.6 Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
 - 4.7 Magnetic field and its units, magnetic lines of force, magnetic flux and their units
 - 4.8 Concept of electromagnetic induction, Faraday's Laws and Lenz's law, Galvanometer and its use.

5. Modern Physics (3 hrs)
 - 5.1 Lasers: its characteristics, spontaneous and stimulated emission, population inversion; Principle, construction and working of Ruby laser, engineering applications of lasers.

LIST OF PRACTICALS (To perform minimum 8 experiments)

1. To find the time period of a simple pendulum
2. To determine and verify the time period of cantilever
3. To verify laws of reflection from a plane mirror.
4. To find the focal length of convex lens by parallax method.
5. To determine the magnifying power of an astronomical telescope
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To verify laws of resistances in series and parallel combination.
8. To find resistance of galvanometer by half deflection method
9. To measure very low resistance and very high resistances using Slide Wire bridge
10. Use of CRO in plotting AC and DC waveforms.
11. To find wave length of the laser beam.

INSTRUCTIONAL STATREGY

Teacher may use various instructional media like models, charts and graphs while imparting instructions. The field application should be made clear before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

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. Practical Physics by C. L. Arora, S Chand Publications
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	06	10
4	09	15
5	03	05
Total	30	50

2.4 ENVIRONMENTAL STUDIES

L	P
2	-

RATIONALE

Engineering activities require the use of natural resources which results in wide-ranging adverse effects on the environment. Natural replenishment of these resources is practically impossible. This necessitates that all technicians should know about the basics of ecology, environment and its functions, environmental pollution and management and environmental legislation which will enable them to accomplish their professional work with environmental compatibility. Hence this subject.

LEARNING OUTCOMES

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

- Comprehend the importance of ecosystem and environment.
- Demonstrate interdisciplinary nature of environmental issues.
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of environmental pollutions.
- Compute the impact of human activities on the environment.
- Understand purpose of 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.

DETAILED CONTENTS

1. Introduction: (4 hrs)
Basics of ecology, eco system and environment. Review of carbon, nitrogen, sulphur and water cycle)
2. Conservation of land reforms: (3 hrs)
Desertification, Causes, effects and prevention. rain water harvesting, maintenance of ground water, deforestation – its effects and control measures
3. Environmental Pollution: (10 hrs)
Sources of pollution - natural and man made, causes, effects and control measures of pollution (air, water, noise, soil and radioactive). Concept of BOD, COD and AQI, Prevention of Pollution- Introduction to Cleaner Production Technologies, Waste Minimization Techniques, Concept of Zero Discharge, Impact of Energy

Usage on Environment: Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain.

4. Solid Waste management (3 hrs)
Classification of refuse material, sources, effects and control measures. Introduction to E-waste Management
5. Environmental Legislation (4 hrs)
Introduction to Water (prevention and control of pollution) Act, Air (Prevention and Control of Pollution) Act and Environmental Protection Act, Role and Function of State Pollution Control Board, Introduction to Energy Conservation Act & its importance, Concept of Environmental Impact Assessment (EIA)
6. Energy Conservation and Sustainable Development (6 hrs)
Introduction to Energy Management, Energy Conservation, Energy efficiency and its need. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio mass energy, hydro energy) in environmental protection. Sustainable development, Concept of Green building and eco friendly materials.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits etc. may also be organized.

RECOMMENDED BOOKS

1. Sharma, BR, "Environmental and Pollution Awareness", Satya Prakashan, New Delhi.
2. Khitoliya, Dr. RK, "Environmental Pollution", S Chand Publishing, New Delhi.
3. Deswal and Deswal, "Environmental Science", Dhanpat Rai and Co. (P) Ltd. Delhi.
4. Bharucha, Erach, "Environmental Studies", University Press (India) Private Ltd., Hyderabad.
5. Dhamija, Suresh K, "Environmental Engineering and Management", SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	3	05
3	10	16
4	3	05
5	4	06
6	6	12
Total	30	50

2.5 BASIC ELECTRONICS

L	P
3	2

RATIONALE

This subject gives the knowledge of fundamental concepts and principles of basic electronics and aims at providing the students with basic understanding of various types of materials such as conductors, semiconductors, insulators, extrinsic and intrinsic semi-conductors. It also gives exposure of p-n junction, need of rectifiers, significance and use of filters in rectifiers, basic structure and working principle of tunnel diodes, LEDs, varactor diodes, LCD. This subject will help the students to learn the working of transistors in various configurations; fundamental knowledge of FETs, MOSFETs and their applications.

LEARNING OUTCOMES

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

- Identify and take readings on various electronics equipment (multimeter, CRO, signal generator, LCR meter).
- Plot the VI characteristics of pn junction diode and Zener diode.
- Measure voltage gain, input and output impedance in a single state CE amplifier circuit.
- Assemble half wave, full wave and bridge rectifier and observe waveforms of each.
- Plot the waveforms of the rectifier circuit with different filters.
- Plot input and output characteristics of transistor in CB and CE mode.
- Plot the characteristics of FET based amplifier.
- Measure voltage gain, input and output impedance in a single state CE amplifier circuit

DETAILED CONTENTS

1. Semiconductor Physics (02 hrs)
 - 1.1 Concept of intrinsic and extrinsic semi-conductor, process of doping.
 - 1.2 P and N type semiconductors and their conductivity
2. Semiconductor Diode (10 hrs)
 - 2.1 PN junction diode, mechanism of current flow in PN junction, forward and reverse biased PN junction, potential barrier, drift and diffusion currents, depletion layer, concept of junction capacitance in forward and reverse biased condition.
 - 2.2 V-I characteristics of diode.
 - 2.3 Application of diode as half-wave, full wave and bridge rectifiers. Peak Inverse Voltage, shunt capacitor filter, series inductor filter, LC and RC filters.
 - 2.4 Types of diodes, characteristics and applications of Zener diodes. Zener and avalanche breakdown.
3. Introduction to Bipolar-Transistors (10 hrs)
 - 3.1 Concept of a bipolar transistor, its structure, PNP and NPN transistors, their symbols and mechanism of current flow; Current relations in a transistor; concept of leakage current;
 - 3.2 CB, CE, CC configurations of a transistor; Input and output characteristics in CB and CE configurations; Current amplification factors. Comparison of CB, CE and CC Configurations;
 - 3.3 Transistor as an amplifier in CE Configuration; concept of DC load line and calculation of current gain and voltage gain using DC load line.

4. Transistor Biasing Circuits (05 hrs)
 - 4.1 Concept of transistor biasing and selection of operating point.
 - 4.2 Need for stabilization of operating point.
 - 4.3 Different types of biasing circuits.
5. Single Stage Transistor Amplifier (05 hrs)
 - 5.1 Single stage transistor amplifier circuit.
 - 5.2 AC and DC equivalent circuit for single stage transistor amplifier
 - 5.2 AC load line and its use in explanation of phase reversal of output voltage with respect to input voltage.
6. Field Effect Transistors (13 hrs)
 - 6.1 Construction, operation and characteristics of FETs and their applications.
 - 6.2 Construction, operation and characteristics of a MOSFET in depletion and enhancement modes and its applications.
 - 6.3 C MOS - advantages and applications
 - 6.4 Comparison of JFET, MOSFET and BJT.
 - 6.5 FET amplifier circuit and its working principle without Derivation.

LIST OF PRACTICALS

1. Operation and use of the following instruments:
Multi-meter, CRO, Signal generator, LCR meter, Regulated Power Supply by way of taking readings of relevant quantities with their help.
2. Plotting of V-I characteristics of a PN junction diode
3. Plotting of V-I characteristics of a Zener diode

4. Measurement of the voltage gain, input and output impedance in a single state CE amplifier circuit.
5. Measurement of voltage gain, input and output impedance in a single state CB amplifier circuit.
6. Design of half-wave rectifier circuit on breadboard and observe its output.
7. Design of full-wave rectifier circuit on breadboard and observe its output.
8. Plotting of the wave shape of Bridge-rectifier circuit using four diodes with
 - a. Shunt capacitor filter
 - b. Series inductor filter
 - c. RC filter
9. Plotting of input and output characteristics and calculation of parameters of transistors in CE configuration.
10. Plotting of input and output characteristics and calculation of parameters of transistors in CB configuration.
11. To study the following biasing technique of transistor.
 - a. Fixed Biasing
 - b. Constant Base Biasing
 - c. Self Biasing
12. Plotting of V-I characteristics of a FET based amplifier.

INSTRUCTIONAL STRATEGY

The aim of this subject is to provide the knowledge of the fundamental concepts related to basic electronics. The teacher should give more emphasis on understanding of concepts and the measuring of various terms used in the subject. The students be made familiar with diodes, transistors, resistors, capacitors, inductors etc. and various measuring instruments such as Multi-meter, CRO, Signal generator, LCR meter, Regulated Power Supply etc. Practical exercises should be included to reinforce the various concepts. Practical applications of semiconductor diodes, transistors, field effect transistors etc must be elucidated to the student.

RECOMMENDED BOOKS

1. Bhargava, NN, “Basic Electronics and Linear Circuit”, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd., New Delhi.
2. Malvino, Albert Paul, “Principles of Electronics”, Tata McGraw Hill Education Pvt Ltd., New Delhi.
3. Malvino, Albert, and David J.Bates, “Basic Electronics – Problems and Solutions”, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.
4. Katre, J.S., “Basic Electronics”, Sandeep Bajaj, Tech. Max. Publications, Pune.
5. Sahdev, SK, “Electronic Principles”, Dhanpat Rai & Co., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	02	02
2	10	11
3	10	11
4	05	06
5	05	06
6	13	14
Total	45	50

2.6 BASIC ELECTRICAL ENGINEERING

L	P
3	2

RATIONALE

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

LEARNING OUTCOMES

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

- Take the readings on various electrical equipment like voltmeter, ammeter, CRO, wattmeter, multi-meter.
- Determine voltage-current relationship in a DC circuit under specific physical conditions.
- Measure resistance of an ammeter and a voltmeter.
- Verify DC circuits (Thevenin and Nortons Theorem).
- Identify and connect a battery in a circuit..
- Measure power and power factor in a single phase R-.L-.C. Circuit and calculation of active and reactive powers in the circuit.

DETAILED CONTENTS

1. Overview of DC Circuits (03 hrs)
 - 1.1 Simple problems on series and parallel combination of resistors
2. DC Circuit Theorems (06 hrs)
 - 2.1 Thevenin's theorem, Norton's theorem, application of network theorems in solving D.C. circuit problems.
3. Voltage and Current Sources (04 hrs)
 - 3.1 Concept of voltage source, symbol and graphical representation characteristics of ideal and practical sources.
 - 3.2 Concept of current sources, symbol, characteristics and graphical representation of ideal and practical current sources.
4. Batteries (02 hrs)
 - 4.1 Basic idea of primary and secondary cells
 - 4.2 Series and parallel connections of batteries
 - 4.3 General idea of solar cells, solar panels and their applications
5. AC Fundamentals (10 hrs)
 - 5.1 Concept of alternating quantities
 - 5.2 Difference between ac and dc
 - 5.3 Concepts of cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor.
 - 5.4 Representation of sinusoidal quantities by phasor diagrams.
 - 5.5 Equation of sinusoidal wave form for an alternating quantity and its derivation
 - 5.6 Effect of alternating voltage applied to a pure resistance, pure inductance and pure capacitance.

6. Transformer (04 hrs)
- 6.1 General construction and principle of different type of transformers
- 6.2 Emf equation and transformation ratio of transformers
7. AC Circuits (16 hrs)
- 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, active and reactive power and their significance, definition and significance of power factor.
- 7.6 Definition of conductance, susceptance, admittance, impedance and their units

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 Thevenin's theorem for dc circuits.
5. Verification of Norton's theorem for dc circuits.
6. Observation of change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
7. Determination of voltage-current relationship in an inductive circuit.
8. Determination of voltage-current relationship in a capacitive circuit.
9. Determination of voltage-current relationship in a series R-L circuit.
10. Determination of voltage-current relationship in a series R-C circuit.
11. To study the resonance condition of a series LCR circuit, and determine its quality factor (Q), bandwidth (BW)
12. Measurement of power and power factor in a single phase R-L-C. circuit and calculation of active and reactive powers in the circuit.

INSTRUCTIONAL STRATEGY

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.

RECOMMENDED BOOKS

1. Dhogal, PS, “Basic Electrical Engineering”, Tata Mc Graw-Hill Education Pvt Ltd., New Delhi.
2. Sahdev, SK, “Basic Electrical and Electronics Engineering”, Dhanpat Rai and Co, New Delhi.
3. Bhattacharya, SK, and KM Rastogi, “Experiments in Basic Electrical Engineering”, New Age International (P) Ltd.; Publishers New Delhi.
4. Theraja, BL, “Electrical Technology”, S Chand and Co, New Delhi.
5. Gupta, BR, “Principles of Electrical Engineering”, S Chand and Co, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	03	04
2	06	06
3	04	05
4	02	04
5	10	11
6	04	04
7	16	16
Total	45	50

2.7 ELECTRICAL AND ELECTRONICS WORKSHOP

L P
- 6

RATIONALE

This workshop is very important to understand technological and industrial processes. This workshop will help in developing mental and manual abilities to handle engineering materials with hand tools, quality and safety measures. It will further help in developing elementary abilities in the field of electric and electronics which will find applications in other subjects.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Use testing instruments like CRO, DSO, Multimeter etc.
- Describe working and identification of diode and transistors.
- Develop technical skill for connections of various types of cables.
- Understand various types of protective devices of electrical and electronics.

DETAILED PRACTICE EXERCISES

1. **Electrical Workshop:** Safety precaution, electric shock treatment.

Demonstration of tools commonly used in Electric workshop.

Electronics Workshop: Identification and familiarization with the following electronic instruments:

- a) Identification and familiarization with commonly used tools in electronics workshop and their uses.

- b) Measuring Instruments: Continuity tester, Voltmeter, Ammeter, Ohmmeter, multimeter (analog and digital).
- c) CRO and DSO: Function of every knob on the front panel
- d) Function Generator: Function of every knob on the front panel and observing its output on CRO/DSO.
- e) Power supply: Fixed voltage and variable voltage, single output as well as dual output.

2. Electrical Workshop: Demonstration of common Electric materials like

- Wires, fuses, circuit breakers, ceiling fans, batteries, cleats and allied items.
- Various types of single, multi-cored insulated screened pour, general purpose wires/cables.
- **Job:** Wiring Practice in batten wiring, plastic casing-capping and conduit.

Electronics Workshop:

- Study of wires & cables and develop technical skill to cut, strip, join and insulate two length of wires/cables (repeat with different types of wires/cables).
- Identification and familiarization with active and passive components and their symbols;
- Colour code and types of resistors
- Familiarisation to potentiometer, VDR, LDR and thermistor;

3. Electrical Workshop:

Demonstrate (or explain) uses of the items mentioned below:

- a. Various types of plugs, sockets, connectors suitable for general purpose use. Some of such connectors are: 2 and 3 pin mains plug and sockets, Banana plugs and sockets, BNC, RCA, DIN, UHF, Earphone speaker

connector, telephone jacks and similar male and female connectors and terminal strips.

Job: Control of one lamp by one switch / two switches.

Job: Control of one socket by one switch & two sockets by two switches.

Electronics Workshop:

- Identification of diode and transistor terminals. Identification of other components including LED, LCD, UJT, FET, Coils, relays, switches (SPDT, DPDT, etc), connectors, micro-switches, reed relays, transformer (mains, audio and RF etc),
- Testing of active and passive components

4. Electrical Workshop: Demonstrate (or explain) the joining (or connecting) methods or/and mounting and dismantling method as well as uses of the items mentioned below:

- a. Various types of switches such as: normal/miniature toggle, slide, push button, piano key, rotary, SPST, SPDT, DPST, DPDT, MCB, band selector, multiway Master Mains Switch.
- b. Various types of protective devices such as: Wire fuse, cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multi-pole miniature circuit breakers, over and under current relays.

Job: Assemble a Tube light.

Electronics Workshop: To develop technical skill to connect/solder/crimp different kinds of wires/cables (including shielded cable) to different types of Power / General purpose / Audio / Video / Telephone plug, socket, jacks like RJ-45, terminal, binding posts, terminal strip, connector's.

5. Electrical Workshop: Demonstration of voltmeter, Ammeter, Multimeter (digital and analog) and Energy meter.

- a. **Job:** Laying out of complete wiring of Direct on line (DoL) Starter .

- b. **Job:** Laying out of complete wiring of an induction motor (Single-phase and Three-phase).
- c. Reversing direction of rotation of single phase motor and three phase motor.
- d. **Job:** Dismantle study, find out fault, repair the fault, assemble and test domestic appliances like Electric Iron, Electric Mixer, Ceiling & Table fan, Tube light, Water heater (Geyser) and desert cooler.

Electronics Workshop:

- Assembly and testing of following circuit on bread board and viewing its output waveform on CRO:
 - a. Half Wave Rectifier
 - b. Full Wave Rectifier (using Centre Tap Transformer)

RECOMMENDED BOOKS

- 1. Singh, RP, “Electrical Workshop: Safety, Commissioning, Maintenance & Testing of Electrical Equipment”.
- 2. Singh, Harbeer, and Bharat Bhushan, “Jain Basic Electrical & Electronics Lab”.
- 3. Navas, K.A., “Electronics Lab Manual: Volume I”, PHI.
- 4. Kothari, “Basic Electrical & Electronics”, McGraw Hill.
- 5. Kothari, D P, and I J Nagrath, “Basic Electronics”, McGraw Hill Education.

Note: Demonstration Boards and charts for the above components shall be made.

2.8 GENERAL WORKSHOP - II

L P
- 4

RATIONALE

Psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs including machining. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

LEARNING OUTCOMES

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

- Select materials, sequence of operations, select tools to make a given job based on interpretation of drawing as per given specification with close tolerances using at least the resources of three shops.
- Prepare a job as per given specifications for a given shop.
- Specify and read/understand specifications of different types of tools, equipment and machines used in various shops.
- Inspect visually to identify various types of defects in different type of materials.
- Analyze a given job and identify various operations required to make it.
- Follow safety procedures and measures.
- Maintain good housekeeping practices.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop uniform 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 workshops will be explained for conduct of practical. The students should prepare sketches of various tools/jobs sequence of operations etc. in their practical notebook.

The following shops are included in the syllabus.

- 1 Welding Shop –II
- 2 Fitting Shop – II
- 3 Sheet Metal Shop –II
- 4 Electric Shop -II
- 5 Carpentry Shop –II
- 6 Electronic Shop –II

1. WELDING SHOP –II

- 1.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to gas welding (Oxy-acetylene welding, Air acetylene welding, Oxy-hydrogen welding). Introduction to gas welding equipment: - Gas welding torch, cylinders, Blow pipe and Pressure regulators etc. Types of gas welding flames. Functions of filler materials and fluxes. Introduction to soldering and brazing. Difference between welding, soldering and brazing. Introduction to resistance welding.
- 1.2 Demonstration of Gas welding equipment, TIG, MIG and Spot welding machines. Demonstration of brazing and soldering
- 1.3 Jobs to be prepared:
 - Job I Making a lap joint on 75 mm × 35 mm × 3mm M.S. plate using gas welding (Oxy-acetylene).
 - Job II Making a simple job on spot welding machine.

2. FITTING SHOP - II

- 2.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, function and specification of different types of cutting tools (chisels and scrapers etc.), tightening tools (pliers, screw driver, wrenches etc.) types of drill and drilling machines used in fitting shop. Classification of files: according to cut, grade, and shape. Measuring devices (Fillet/radius gauge, screw pitch gauge, wire gauge, telescopic gauge), Vernier height gauge. Surface gauge and universal surface gauge. Description of drill, reamer, tap and die set. Selection of dies for threading, selection of drill size for tapping.
- 2.2 Demonstration on use of various measuring tools (Vernier caliper, Vernier height gauge and outside and inside micrometers etc.), finding least count and checking of zero error. Demonstration of various types of drills, taps and dies.

2.3 Jobs to be prepared:

- Job I To make a job by drilling and tapping (manually) process on soft metals- Aluminum or Copper or Bronze.
- Job II To Make 'U' type cut-out profile from a square piece of MS flat using hand hacksaw, filing, marking, drilling and measuring operations up to an accuracy of ± 0.1 mm.

3. SHEET METAL SHOP - II

- 3.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and functions of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Wood Turning Machine, Wiring Machine, Setting Down Machine, Forming Machine, Fly press etc. Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing, Introduction to metal spinning process. Introduction of various types of nuts, bolts, screws etc.
- 3.2 Demonstration of various machines and types of nuts, bolts, screws etc.
- 3.3 Jobs to be prepared:
 - Job I To prepare a job involving soldering or brazing process.
 - Job II To fabricate a funnel/conduit pipe from GI sheet.

4. ELECTRIC SHOP - II

- 4.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE), Introduction and use of single phase and three phase supply, its wiring system and importance. Introduction and function of an electric motor for any three-phase electric machine. Estimating and costing of power consumption. Identification and familiarization with the following tools: Tweezers, Screw Drivers (Different sizes), Insulated pliers, Cutters, Sniper, Philips Screw driver (star screw driver), L-Keys.
- 4.2 Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc. Testing and reversing direction of rotation of single phase and three phase motors and their wiring methods.
- 4.3 Job Practice:
 - Job I Connection of single-phase energy meter with supply and load including reading and working out power consumption and cost of energy.
 - Job II Finding faults in electric circuits, machines, with series testing lamp and multimeter.
 - Job III Connection and wiring practice for reversing direction of rotation of single phase and three phase motors.

5. CARPENTRY SHOP – II

- 5.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, parts and functions of Jig saw and radial saw wood working machine, Band saw, Circular saw and Electric Planer. Introduction and basic functions of Wood working lathe and its tools. Saw re-sharpening machine, wood working lathe, Saw Brazing unit.
- 5.2 Demonstration of Rip Saw, dovetail saw and Tenon saw. Method of sharpening various saws. Demonstration on Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.
- 5.3 Jobs to be prepared:
 - Job I Preparation of mitre joint.
 - Job II Preparation of a lengthening joint

6. ELECTRONIC SHOP – II

- 6.1 Identification and familiarization with tools used in laying of networking, monitoring systems.
- 6.2 Identification and familiarization with different types of Routers, Modems, Switches, Smart hubs etc.
- 6.3 Job Practice
 - Job I Creation of LAN. connecting at least 4 systems.
 - Job II Use of various types of switches and protective devices in electronic circuits
 - Job III To make regulated power supply on general purpose PCB.

Note:-

1. Workshop instructors will guide and help the students throughout the practical class in order to explain and complete the job according to syllabus and for providing necessary facilities to the students during performance of practical by observing the safety precautions
2. The Workshop Superintendent or Foreman Instructor or Instructor will demonstrate and deliver the theoretical instructions with regard to introduction, functions, classification and specification of tools, instruments, equipment, apparatus etc. of all the topics covered in the syllabus of workshops.
3. The Workshop Superintendent or Foreman Instructor will also conduct the mid-term test and final practical exam of this subject.

RECOMMENDED BOOKS

1. Singh, Swaran, “Workshop Practice”, S.K. Kataria & Sons, Engineering Books New Delhi.
2. Bawa, HS, “Workshop Practice”, Tata McGraw Hill Publishers, New Delhi.
3. Choudhary, SK Hajra, and AK Choudhary, “Workshop Technology I, II, III”, Media Promoters and Publishers Pvt. Ltd. Mumbai.
4. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
5. Raghuwanshi, B.S., “Workshop Technology”, Dhanpat Rai and Co., New Delhi.

TRAFFIC AWARENESS & ROAD SAFETY CAMP (II)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety by obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Time management
2. Traffic light signals
3. Speed limits of vehicles
4. Schedule of offences
5. Dividing lines
6. Proper road Maintenance and Warnings
7. Test yourself

3.1 ELECTRONIC INSTRUMENTS AND MEASUREMENT

L P
3 2

RATIONALE

In the real world of work, the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. The study of this subject will help students to gain the knowledge of working principles and operation of different instruments. This subject will help the students to acquire the requisite skills.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Describe the specifications of measuring instruments.
- Demonstrate the working principle of measuring instruments.
- Measure the loading effect of a multi-meter.
- Define the limitation of multi-meter for high frequency measurement.
- Demonstrate the working of RF signal generator, pulse generator.
- Differentiate between active and passive transducers.
- Measure distortion of RF signal generator using Distortion factor Meter.

DETAILED CONTENTS

1. Basics of Measurements (06 hrs)
 - Measurement, method of measurement, types of instruments
 - Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors, loading effect, importance and applications of standards and calibration
2. Transducers (09 hrs)
 - Distinction between active and passive transducers with examples. Basic requirements of a transducer
 - Principle of operation of the following transducers and their applications

in measuring the physical quantities listed against each one of them:

- i. Variable Resistance: Thermistor, Strain Gauge.
- ii. Variable capacitance: Pressure gauge
- iii. Variable inductance: LVDT Type
- iv. Other: piezoelectric device, Photo Transistor.

3. Cathode Ray Oscilloscope (09 hrs)

- Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls.
- Measurement of current, voltage, frequency, time period and phase using
- CRO Digital storage oscilloscope (DSO) : block diagram and working principle

4 Voltage, Current and Resistance Measurement (06 hrs)

- Principles of measurement of DC voltage, DC current, AC voltage, AC current,
- Principles of operation of permanent magnet moving coil (PMMC) instruments and Moving iron type instruments

5 Signal Generators and Analytical Instruments (09 hrs)

- Explanation of block diagram specifications of low frequency and RF generators, function generator.
- Harmonic Distortion Analyser, Wave Analyzer.

6. Digital Instruments (06 hrs)

- Comparison of analog and digital instruments
- Block diagram and working of a digital multi-meter
- Specifications of digital multi-meter and their applications
- Limitations of digital multi-meters.

LIST OF PRACTICAL EXERCISES

1. To observe the loading effect of a multi-meter while measuring voltage across a low resistance and high resistance
2. To observe the limitations of a multi-meter for measuring high frequency voltage
3. To measure ac and dc voltage using CRO and DSO.
4. To measure frequency and time period using CRO and DSO.
5. To measure frequency, voltage, time period and phase using CRO and DSO.
6. To measure frequency using Lissajous patterns.
7. To measure phase using Lissajous patterns
8. Measurement and plot of characteristics of LVDT.
9. Characteristics of light operated switch using photo-transistor.
10. Measurement of strain using strain gauge.
11. Measurement of temperature using thermistor.
12. Measurement of distortion of RF signal generator using distortion factor meter
13. To Measure resistance, AC/DC voltage and AC/DC current using Digital Multimeter.
14. Testing of diode and h_{fe} measurement using Digital Multimeter.

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Sawhney, AK, “Electronics Measurement and Instrumentation”, Dhanpat Rai and Sons, New Delhi.
2. Oliver, and Cage, “Electronics Measurement and Instrumentation”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
3. Cooper, W. D., “Electronics Instrumentation”, Prentice Hall of India, New Delhi.
4. Sapra, Rajiv, “Electronics Test and Instrumentation”, Ishan Publications, Ambala.
5. Gupta, JB, “Electronics Instrumentation”, Satya Prakashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	06	06
2.	09	10
3.	09	10
4.	06	07
5.	09	10
6.	06	07
Total	45	50

3.2 PRINCIPLES OF COMMUNICATION ENGINEERING

L	P
2	4

RATIONALE

The study of principles of communication systems leads to further specialized study of audio and video systems, line communications and microwave communication systems. Thus the students shall find employment in the areas of production, servicing and maintenance of various communication systems. The students should understand the advantage and limitations of various analog and digital modulation systems on a comparative scale.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Explain the concept and need of modulation and demodulation
- Measure the modulation index of the Amplitude Modulated wave
- Calculate the frequency deviation of FM wave for different modulating signals
- Use different types of modulators and demodulators
- Obtain modulating signal from an AM Detector and FM Detector

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Introduction | (01 hrs) |
| | <ul style="list-style-type: none"> • Need for modulation, • Basic scheme of a modern communication system. | |
| 2. | Amplitude Modulation | (05 hrs) |
| | <ul style="list-style-type: none"> • Derivation of expression for an amplitude modulated wave. Carrier and side band components. Modulation index. BW of AM Wave. • Elementary idea of DSB-SC, SSB-SC and VSB modulations, their comparison, and areas of applications | |

3. Angle modulation (05 hrs)

- Expression for frequency modulated (FM) wave and its frequency spectrum (without Proof and analysis of Bessel function) Modulation index, maximum frequency deviation and deviation ratio, BW of FM signals, Carson's rule.
- Effect of noise on FM carrier. Role of limiter, Need for pre-emphasis and de-emphasis.
- Comparison of FM and AM in communication systems
- Expression for phase modulated (PM) wave (Without derivation), modulation index, deviation ratio.

4. Principles of AM Modulators and Demodulators (09 hrs)

Working principles of AM Modulators:

- Square Law Modulator
- Balanced Modulator
- Ring Modulator

Working principles of AM Demodulators:

- Diode detector circuit (envelope detector),
- Synchronous detector

5. Principles of FM Modulators and Demodulators (10 hrs)

Working principles of FM Modulators:

- Varactor diode modulator (VCO) and Armstrong phase modulator.

Working principles of FM Demodulators:

- Basic principles of FM detection using slope detector
- Foster-Seeley discriminator
- Ratio detector
- Block diagram of Phase locked Loop (PLL) FM demodulators (No Derivation)

LIST OF PRACTICAL EXERCISES

1. To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation
2. To measure the modulation index of the AM wave on CRO produced by a standard signal generator.
3. To obtain an AM wave from a square law modulator circuit and observe waveforms
4. To measure the modulation index of AM wave from a square law modulator circuit and observe the effect of carrier amplitude on modulation index.
5. To obtain an FM wave and measure the frequency deviation for different modulating signals.
6. To obtain modulating signal from an AM wave with diode detector circuit (envelope detector) and observe the pattern.
7. To obtain modulating signal from an AM wave with synchronous detector and observe the pattern.
8. To obtain modulating signal from FM wave using slope detector.
9. To obtain modulating signal from FM wave using Foster-Seeley discriminator.
10. To obtain modulating signal from FM wave using Ratio detector.
11. To obtain modulating signal from FM wave using Phase locked Loop (PLL).

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Kennedy, “Electronics Communication System”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Taub, Herbut, Donald L. Schilling, and Goutam Saha, “Principles of Communication Engineering”, Tata McGraw Hill Education Pvt Ltd.
3. Jamwal, KS, “Electronics Communication”, Dhanpat Rai and Co, New Delhi.
4. Singh, Anokh, “Principles of Communication Engineering”, S.Chand and Co., New Delhi.

5. Roody, Dennis, and John Coolen, “Principles of Communication Engineering”, Prentice Hall.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	01	05
2.	05	10
3.	05	10
4.	09	10
5.	10	15
Total	30	50

3.3 DIGITAL ELECTRONICS

L	P
3	2

RATIONALE

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject will help the students to understand the working of all logic gates. It will give exposure to the students about various combinational and sequential circuits along with their truth table and working.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Verify and interpret truth tables for all logic gates.
- Realize all logic functions with AND, OR, NOT, NAND and NOR gates
- Design half adder and full adder circuit
- Demonstrate and design 4-bit adder, 2's complement subtractor
- Interpret and verify truth tables for all flip flops.
- Understand and verify truth tables of multiplexer, de-multiplexer, encoder and decoder ICs
- Design a four bit ring counter and verify its operation
- Design 4-bit SISO, PISO, SIPO, PIPO shift registers

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Introduction | (02 hrs) |
| | a) Distinction between analog and digital signal. | |
| | b) Applications and advantages of digital signals. | |
| 2. | Number System | (04 hrs) |
| | a) Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa | |

- b) Binary addition, subtraction, multiplication and division including binary points. Sign magnitude method of representation, 1's and 2's complement method of addition/subtraction, floating point representation
3. Codes and Parity (04 hrs)
- a) Concept of code, weighted and non-weighted codes, examples of BCD, excess-3 and Gray code.
 - b) Concept of parity, single and double parity and error detection and correction (Hamming code)
 - c) Alpha numeric codes: ASCII, EBCDIC and Unicode.
4. Logic Gates (06 hrs)
- a) Concept of negative and positive logic
 - b) Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates).
5. Logic Simplification (05 hrs)
- a) Postulates of Boolean algebra, De Morgan's Theorems. Various identities. Formulation of truth table and Boolean equation for simple problem. Implementation of Boolean (logic) equation with gates
 - b) Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits
6. Arithmetic circuits (05 hrs)
- a) Half adder and Full adder circuit, design and implementation.
 - b) Half and Full subtractor circuit, design and implementation.
 - c) 4 bit adder/subtractor.
 - d) Adder and subtractor IC (7484)
 - e) 2-bit comparator

7. Decoders, Multiplexers and De-Multiplexers (06 hrs)
- a) Basic functions and block diagram of Encoders and decoders.
 - b) Basic functions and block diagram of Multiplexers and De-Multiplexers. Different types and ICs.
 - c) Four bit decoder circuits for 7 segment display and decoder/driver ICs.
8. Latches and flip flops (04 hrs)
- a) Concept and types of latch with their working and applications
 - b) Operation using waveforms and truth tables of RS, T, D, JK and Master/Slave JK flip flops.
 - c) Difference between a latch and a flip flop
 - d) Flip flop ICs
9. Shift Register (06 hrs)
- Introduction and basic concepts including shift left and shift right.
- a) Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
 - b) Universal shift register
 - c) Buffer register, Tristate Buffer register
 - d) IC 7495
10. Counters (03 hrs)
- a) Introduction to Asynchronous and Synchronous counters
 - b) Binary up/down counters (upto MOD-8)
 - c) Decade counter.
 - d) Pre settable and programmable counters
 - e) Ring counter with timing diagram
 - f) Counter ICs

LIST OF PRACTICAL EXERCISES

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

Note: Above experiments may preferably be done on Bread Boards.

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. Programming exercises other than the tested in circulation may be given to the students.

RECOMMENDED BOOKS

1. Malvino Leach, "Digital Electronics and Applications", Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Morris Mano, "Digital Logic Designs", Prentice Hall of India, New Delhi.
3. Floyd and Jains, "Digital Fundamentals", Pearson Education.

4. KS Jamwal, “Digital Electronics”, Dhanpat Rai and Co., New Delhi.
5. RJ Tocci, “Digital Systems: Principles and Applications”, Prentice Hall of India, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	02	02
2.	04	05
3.	04	05
4.	06	08
5.	05	05
6.	05	05
7.	06	06
8.	04	04
9	06	06
10.	03	04
Total	45	50

3.4 ELECTRONIC DEVICES AND CIRCUITS

L	P
3	2

RATIONALE

This course will enable the students to learn about the use of transistors in analog circuits like power amplifier, multistage amplifier, oscillators, wave shaping circuits and in multivibrators etc. It also gives information about timer, operational amplifier, voltage regulator, ICs and their applications for effective functioning in the field of electronic service industry.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Demonstrate the working of multistage amplifiers.
- Measure the bandwidth of multistage amplifier.
- Describe the operation of large signal amplifiers.
- Demonstrate the concept of negative and positive feedback.
- Calculate the gain of emitter follower and push pull amplifiers.
- Plot the frequency response of oscillators (Hartley, Colpitt, Wein Bridge).
- Explain the concept of feedback amplifiers.
- Draw the frequency response of tuned voltage amplifiers.
- Design various wave-shaping circuits (concepts of clipping and clamping).
- Describe the concept of multi-vibrators and operational amplifiers.
- Demonstrate the working of operational amplifier as inverter, integrator, differentiator, adder and subtractor.
- Describe the concept of regulated DC supplies and opto-electric devices, VCO and PLL

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Multistage Amplifiers | (05 hrs) |
| | <ul style="list-style-type: none"> • Need for multistage amplifier • Gain of multistage amplifier | |

- Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth

2. Large Signal Amplifier (08 hrs)

- Difference between voltage and power amplifiers
- Importance of impedance matching in amplifiers
- Class A, Class B, Class AB, and Class C amplifiers, collector efficiency and
- Distortion in class A,B,C
- Single ended power amplifiers, Graphical method of calculation (without derivation) of output power; heat dissipation curve and importance of heat sinks. Push-pull amplifier, and complementary symmetry push-pull amplifier

3. Feedback in Amplifiers (08 hrs)

- Basic principles and types of feedback
- Derivation of expression for gain of an amplifier employing feedback
- Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier
- RC coupled amplifier with emitter bypass capacitor
- Emitter follower amplifier and its application

4. Sinusoidal Oscillators (08 hrs)

- Use of positive feedback
- Barkhausen criterion for oscillations
- Different oscillator circuits-tuned collector, Hartley, Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles (no mathematical derivation and numerical problems)

5. Wave Shaping Circuits (04 hrs)

- General idea about different wave shapers
- RC and RL integrating and differentiating circuits with their applications
- Diode clipping and clamping circuits.

6. Multivibrator Circuits (06 hrs)

- Working principle of transistor as switch
- Concept of multi-vibrator: astable, monostable, and bistable and their applications
- Block diagram of IC555 and its working and applications
- IC555 as monostable and astable multi-vibrator

7. Operational Amplifiers (06 hrs)

- Characteristics of an ideal operational amplifier and its block diagram
- Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current
- Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator

LIST OF PRACTICAL EXERCISES

1. Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth.
2. Plot the frequency response of two stage transformer coupled amplifier and calculate the bandwidth.
3. Plot the frequency response of two stage direct coupled amplifier and calculate the bandwidth.
4. To measure the gain of push-pull amplifier at 1KHz
5. To construct and test the class A power amplifier.
6. To study the effects of voltage series feedback (negative) on the amplifier characteristics
7. Plot the frequency response curve of Hartley and Colpitt's Oscillator
8. Plot the frequency response curve of phase shift Oscillator
9. Plot the frequency response curve of Wein bridge Oscillator
10. Use of IC 555 as monostable multivibrator and observe the output for different values of RC
11. Use of IC 555 as astable multivibrator and observe the output at different duty cycles
12. To use IC 741 (op-amplifier) as Inverter, Adder, Subtractor, Integrator

INSTRUCTIONAL STRATEGY

This subject being of fundamental importance for diploma holders in electronics engineering and related fields, emphasis on conceptual understanding may be given by taking the help of charts, simulation packages etc. Sufficient exercises may be given to the students in single stage and multi-stage amplifier circuits in addition to simple exercises in fabricating and testing of various simple d.c circuits. The students may be encouraged to perform some additional practical exercises apart from the list provided.

RECOMMENDED BOOKS

1. Kulshreshtha, D. C., and N. N. Bhargava, "Basic Electronics and Linear Circuits", Tata McGraw Hills, New Delhi.
2. Sahdev, "Electronic Principles", Dhanpat Rai and Sons, New Delhi.
3. Malvino, "Electronics Principles", Tata McGraw Hills, New Delhi.
4. Grob, "Basic Electronics", Tata McGraw Hills, New Delhi.
5. Gaykwad, Ramakant A., "Operational Amplifiers and Linear Integrated Circuits", Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	05	06
2.	08	09
3.	08	09
4.	08	09
5.	04	05
6.	06	06
7.	06	06
Total	45	50

3.5 ELECTRICAL MACHINES

L	P
3	2

RATIONALE

This subject will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, students 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

By the end of this course, students should be able to:

- Describe star delta 3-phase connections
- Explain phase, line voltages and current relationships in 3-phase power supply.
- Demonstrate the concept of single phase transformers Measure the power and power factor in 3 phase load Determine the efficiency of a single phase transformer Apply the working principle of rotating electrical machines.
- Demonstrate the working of DC, AC and single phase fractional kilowatt motors. Connect and run a DC shunt motor with supply through a 3 point starter

DETAILED CONTENTS

- | | | |
|----|--------------------|----------|
| 1. | Three Phase Supply | (05 hrs) |
|----|--------------------|----------|
- Advantage of three-phase system over single-phase system
 - Star delta connections
 - Relation between phase and line voltage and current in a three phase system
 - Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.

2. Transformers (06 hrs)

Principle of operation and constructional details of single phase transformer

- Voltage regulation of a transformer without derivation
- Losses in a transformer
- Efficiency, condition for maximum efficiency and all day efficiency
- Current transformer (CT) and potential transformer (PT)

3. Introduction to Rotating Electrical Machines (08 hrs)

- E.M.F. induced in a coil rotating in a magnetic field
- Definition of motor and generator
- Basic principle of a generator and a motor
- Basic electromagnetic laws (Faraday's laws of Electromagnetic Induction)

4. DC Machines (10 hrs)

- Principle of working of d.c. motors and d.c generator
- Function of the commutator for monitoring and generating action
- Factors determining the speed of a DC motor
- Different types of excitation
- Characteristics of different types of DC machines
- Application of DC machines

5. AC Machines (10 hrs)

- Revolving magnetic field produced by poly phase supply
- Brief introduction about three phase induction motors, its principle of operation
- Principle and working of Synchronous Machines
- Application of Synchronous Machines

6. Single Phase Fractional Kilowatt Motors (06 hrs)

- Introduction
- Principle of operation of single phase motors

- Introduction to single phase induction motors
- Introduction of servo-motors and stepper motors

LIST OF PRACTICAL EXERCISES

Demonstrate various instruments use viz Ammeter, Voltmeter, Wattmeter, p.f meter etc for their identification and connecting procedure in a circuit.

1. To measure power and power factors in 3 Phase load by two wattmeter method
2. To observe the relation between line voltage/ current and phase voltage/ current in star connection.
3. To observe the relation between line voltage/ current and phase voltage/ current in delta connection.
4. To determine the efficiency of a single phase transformer from the data obtained through open circuit
5. To determine the efficiency of a single phase transformer from the data obtained through short circuit test.
6. Load test on single phase/three phase transformers.
7. Load characteristics of a single phase induction motors
8. To run a synchronous motor with a.c supply and to measure speed to verify the relation $N=120 f / P$
9. Study construction of a stepper motor.
10. Study construction of a servomotor.

INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory without much seeking assistance of the factory staff.

RECOMMENDED BOOKS

1. Bhattacharya, SK, “Electrical Machine”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Bimbhra, P. S., “Electrical Machines”, Khanna Publishers.
3. Nagrath and Kothari, “Electrical Machines”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
4. Bhattacharya, S.K., & KM Rastogi, “Experiments in Basic Electrical Engineering”, New Age International (P) Ltd. Publishers, New Delhi.
5. Thareja, B.L., “Electrical Technology Vol. - I and II”, S Chand and Co. New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	05	06
2.	06	08
3.	08	08
4.	10	10
5.	10	10
6.	06	08
Total	45	50

3.6 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open Elective refers to a course that students can opt for in addition to their primary area of study. The open elective is from an unrelated discipline with the intention to provide exposure in that discipline. It provides the students the opportunity to select and learn a subject related to his/her interest, thus allowing them to explore their passion..

LIST OF SUGGESTED OPEN ELECTIVES

The student can opt one course out of the following:

- 1 Foreign Language
- 2 NCC
- 3 Yoga
- 4 First Aid
- 5 Creative Writing
- 6 Sketching, Drawing and Colour Studies
- 7 Gardening
- 8 Photography
- 9 Legal Studies
- 10 Event Management
- 11 Diet and Nutrition

Open elective can be offered online or offline.

3.6.1 FOREIGN LANGUAGE (French, Japanese, German, Spanish)

L P
2 -

RATIONALE

This course is an introduction to the specific language. Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of the language as a cultural space are the overall objectives of the course. The student should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

LEARNING OUTCOMES

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

- Enhance the level of vocabulary in specific language.
- Manage situational communication in specific language.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Introduction | (06 hrs) |
| | Self introduction, Numbers, Days, Months, Date, Time, and Counting | |
| 2. | Vocabulary | (06 hrs) |
| | My home, My family, My friend, Daily routine, Hobbies, Food, Greeting and Thanking | |
| 3. | Grammar | (12 hrs) |
| | Verb and Verb forms, Articles, Possessive pronouns, Auxiliary verbs, Questions, Present and Past tense | |

4. Theme (06 hrs)

Means of transport, Basic directions, Food, Drink, Family, Groceries and Meals

RECOMMENDED BOOKS

1. Annie Berthet, Hugot et al, “Alter Ego - Méthode de Français”, Hachette.
2. 3 A Corporation, “Minna no Nihongo”, Goyal Publishers, New Delhi.
3. Stefanie Dengler, “NETZWERK Deutsch als Fremdsprache A1”, Goyal Publishers, New Delhi.
4. Jaime Corpas et.al, “Aula International 1”, Difusión, Madrid.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	12	20
4	06	10
Total	30	50

3.6.2 NATIONAL CADET CORPS (NCC)

L	P
2	-

RATIONALE

This course is structured to instil in the students qualities like nationalism, patriotism, discipline, team spirit, esprit-de-corps, leadership, self-confidence, national integration and improve their personality. The objective of the course is to expose the students to a regimental way of life, which is essential to inculcate in them the values of discipline, duty, punctuality, orderliness, smartness, and respect for authority, correct work ethos and self-confidence. In addition, it will inculcate defence services work ethos, which is characterized by hard work, sincerity of purpose, honesty, ideals of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.

LEARNING OUTCOMES

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

- Explain aims and objectives of NCC.
- Understand the importance of national integration.
- Assist Civil Administration in performance of selective duties during disasters.
- Perform drill without arms.
- Contribute towards nation building.
- Provide voluntary social service.

DETAILED CONTENTS

- | | | |
|----|--------------|----------|
| 1. | Introduction | (08 hrs) |
|----|--------------|----------|

Aims and objectives of NCC, Organisation structure and training, NCC Song, National Integration and awareness, Religions, Culture, Traditions and Customs of India, National Integration: Importance and Necessity. Freedom Struggle and Nationalist Movement in India, Problems/ Challenges of national integration, Unity in diversity, Famous leaders of India, Images/ Slogans for national integration, Contribution of youth to nation building

2. Civil Affairs (04 hrs)

Civil Defence Organization and its duties/ NDMA, Types of emergencies/ Natural Hazards, Role of NCC during Natural Hazards/ Calamities

3. Drill Without Arms (08 hrs)

General and Words of Command, Attention, Stand at Ease and Stand Easy, turning and inclining at the halt, Sizing, forming up in three ranks and numbering, open and close order march and Dressing, Saluting at the halt, Getting on parade, dismissing and falling out, Marching, length of pace and time of marching in quick time and halt, slow march and halt, Turning on the march and wheeling, Saluting on the March Individual word of command

4. Personality Development and Leadership (04 hrs)

Personality development, self-awareness, Leadership, life/soft skills, time management and character building.

5. Social Service (06 hrs)

Basics of Social service, and its needs, Social/ Rural Development Projects: MNREGA, SGSY, NSAP; Literacy enhancement and poverty alleviation, Social evils, Contribution of youth towards social welfare.

RECOMMENDED BOOKS

- 1 “Cadet Hand Book (Common Subjects)”, published by DG, NCC.
- 2 “Grooming Tomorrow’s Leaders”, published by DG, NCC.
- 3 “Youth in Action”, published by DG, NCC.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	04	06
3	08	14
4	04	06
5	06	10
Total	30	50

3.6.3 YOGA

L	P
2	-

RATIONALE

Yoga is a practice that connects the body, breath, and mind. It uses physical postures, breathing exercises, and meditation to improve overall health. It not only improves physical health but also mental and spiritual well-being, which are the foundations of life. The course is aimed at developing skills in yoga for strength, flexibility and relaxation.

LEARNING OUTCOMES

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

- Explain the importance of yoga and its effect on health
- Perform yoga in various forms and combinations
- Understand the philosophy of heartfulness meditation.
- Promote positive health and holistic wellness through yoga and meditation.

DETAILED CONTENTS

- | | | |
|----|------|----------|
| 1. | Yoga | (04 hrs) |
|----|------|----------|

Concept, need and importance, Yogic principles, Rules and precautions to be followed by yoga practitioners, Introduction to Ashtanga yoga and Yoga sutra

- | | | |
|----|-------------------|----------|
| 2. | Asanas and Mudras | (14 hrs) |
|----|-------------------|----------|

Basic asanas, Asanas in different postures - Sukshma Vayayam, Pawan Mukhtasan, Surya Namaskar, Hasta Utthanasana, Padahasthasana, Tadasana, Vrikshasana, Tirayak Tadasana, Natarajasana, Vajrasana, Padmasana, Bhujangasana.

Mudras - Concept, Important mudras - Prana Mudra, Varuna Mudra, Prithvi Mudra, Aakash Mudra, Gyana Mudra.

3. Pranayama (06 hrs)

Kapalbhati Pranayama, Nadi Shodhan Pranayama (Anulom Vilom), Bhastrika Pranayama, Ujjayi Pranayama.

4. Meditation (03 hrs)

Heartfulness meditation, Practice on meditation

5. Health Benefits of Yoga and Meditation (03 hrs)

Benefits and effect of Asanas, Mudras and Pranayama on various systems and organs of human body. Relaxation and wellness through meditation

RECOMMENDED BOOKS

1. Saraswati, Swami Satyananda, “Asana, Pranayama, Mudra and Bandha”, Yoga Publication Trust, Bihar.
2. BKS Iyengar, “Light on Yoga”, George Allen and Unwin.
3. Mudras by Heartfulness; Heartfulness Education Trust.
4. Kamlesh D Patel, “The Way of the Heart”, Spiritual Hierarchy Publication Trust
5. Goel, Aruna, “Yoga Education: Philosophy and Practice”, Deep & Deep Publications, New Delhi.
6. Nagendra, H R, and R Nagarathna, “Yoga for Promotion of Positive Health”. Swami Vivekananda Yoga Prakashan.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	14	24
3	06	10
4	03	05
5	03	05
Total	30	50

3.6.4 FIRST AID

L	P
2	-

RATIONALE

First aid is a valuable and life-saving course. The objective of this course is to impart knowledge and skills to the students necessary in an emergency to help sustain life, reduce pain, and minimize the consequences of injury or sudden illness until professional medical help arrives.

LEARNING OUTCOMES

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

- Administer basic life support skills including cardiopulmonary resuscitation
- Provide first aid of simple and multiple system trauma.

DETAILED CONTENTS

1. Basics of First Aid (04 hrs)

First aid, importance of first aid, first aider, laws of first aid, contents of an ideal first aid kit, dealing with an emergency.
2. Emergency Response (10 hrs)

CPR, steps for performing CPR, CPR for newborns and infants, recovery position, first aid in drowning, fractures of bones, causes and types of fractures, dislocation.
3. First Aid in Burns (04 hrs)

Types of burns, danger of burns, first aid in dry burns and scalds, electrical burns, chemical burns, sunburn, heatstroke.
4. First Aid in Wounds and Injuries (06 hrs)

Types of wounds- small cuts and abrasions, Head injury- nose bleed, bleeding gums,

bleeding from varicose veins, Shocks- causes of shock and its first aid.

5. First Aid in Poisoning (03 hrs)

Poisoning by swallowing, gases, injections, skin absorption, Animal bites, snake bites and insect stings.

6. First Aid in Foreign Objects Entering the Sense Organs: (03 hrs)

Foreign body in the eye, ear, nose, skin, swallowing of foreign objects.

Note : Persons from Civil Defence/ National Disaster Response Force (NDRF) etc. can be invited for conduct of first aid classes and demonstration of first aid practices.

RECOMMENDED BOOKS

1. Gauri Goyal, Dr. Kumkum Rajput, Dr. Manjul Mungali,, “First Aid and Health”, SBPD Publishing House
2. Williamson, Swapna Naskar and Goswami Mala, “First Aid and Emergency Care”, Kumar Publishing House, New Delhi.
3. Mahopatra, R., “First Aid for You and Me”, Academic Publishers, New Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	10	18
3	04	06
4	06	10
5	03	05
6	03	05
Total	30	50

3.6.5 CREATIVE WRITING

L P
2 -

RATIONALE

Creative writing is a written art form that uses the imagination to tell stories and compose essays, poetry, screenplays, novels, lyrics, and more. The objective of this course is to acquaint the students with ideas related to creative writing including art, craft and basic skills required for a creative writer.

LEARNING OUTCOMES

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

- Distinguish between literary genres.
- Practice various forms of creative writing.
- Write for various media.

DETAILED CONTENTS

1. Fundamentals of Creative Writing (06 hrs)

Meaning and significance of creative writing, Genres of creative writing: poetry, fiction, Non-fiction, Drama and other forms, Research for creative writing

2. Elements of Creative Writing (10 hrs)

Plot, Setting, Character, Dialogue, Point of view, Literary devices and figurative language, Elements of style, Grammar and the structure of language, Proof reading and editing

3. Traditional Forms of Creative Writing (10 hrs)

Fiction: short story, novella and novel, Poetry, Drama, Essay, Fable, Biography, Memoire and autobiography, Travelogues, Diaries, Self-narrative writing

4. Writing for Media (04 hrs)

Print media, Broadcast media, Internet - Web content writing and blog writing, Advertising

RECOMMENDED BOOKS

1. Anjana Neira Dev. Anuradha Marwah, Swati Pal, “Creative Writing: A Beginner’s Manual”, Pearson Longman, Delhi.
2. Robert Scholes, Nancy R. Comley, Carl H. Klaus, Michael Silverman, “Elements of Literature: Essay, Fiction, Poetry, Drama, Film”, Delhi.
3. Bell, Julia and Magrs, Paul, “The Creative Writing Course-Book”, Macmillan, London.
4. Gardner, John, “The Art of Fiction”, Vintage, New York.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	10	16
3	10	16
4	04	08
Total	30	50

3.6.6 SKETCHING, DRAWING AND COLOUR STUDIES

L	P
2	-

RATIONALE

This course is aimed to develop aesthetic sense of students. It also encompasses training in sketching, drawing and colouring to develop their mental faculties of observation, imagination and creation.

LEARNING OUTCOMES

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

- Sketch common objects and various geometrical and non-geometrical forms found in life and nature.
- Use different medium and materials.
- Use colour judiciously in creation of visual work.
- Prepare collage using various paper and materials.

DETAILED CONTENTS

1. Sketching of Objects and Nature (08 hrs)

Sketching of objects at home like cup, plate, glass, book, pencil box etc.

Sketching of tree, mountain, hills, vegetables flower etc. for Nature study using Pencil, colour Pencil

2. Drawing of Human and Animal Figures (10 hrs)

Drawing of Human and animal form with the help of Basic Geometrical shapes

3. Collage Making (04 hrs)

Creating Collage with the help of coloured cut out papers, picture from a magazine or any easily available materials

4. Colours (08 hrs)

Water colour, Poster colour, Colour theory – Colour system, Colour wheel, Colour dimensions, Drawing with oil pastel colour and dry pastel.

RECOMMENDED BOOKS

1. Betty Edwards, “Color: A Course in Mastering the Art of Mixing Colors”, Penguin Group Inc., New York.
2. Feisner, E., “Colour Studies”, Fairchild Publications, USA.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	10	16
3	04	06
4	08	14
Total	30	50

3.6.7 GARDENING

L	P
2	-

RATIONALE

Gardening activities are fantastic for helping students engage in a way that is more difficult in the classroom. Watching plants grow is a fun and educational experience for them. Their enormous curiosity and excitement over anything new makes them natural for gardening. Growing plant seeds teaches them how nature works and adds to their interest in environmental sustainability.

LEARNING OUTCOMES

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

- Explain various techniques of gardening, cultivation, multiplication, raising of seedlings of garden
- Discuss new and modern techniques of plant propagation.
- Develop interest in nature and plant life.

DETAILED CONTENTS

1. Gardening (06 hrs)

Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design.
2. Gardening Operations (14 hrs)

Soil laying, manuring, watering, management of pests and diseases and harvesting.
3. Sowing/Raising of Seeds and Seedlings (10 hrs)

Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification. Transplanting of seedlings.

RECOMMENDED BOOKS

1. Bose T.K., Mukherjee, D., “Gardening in India”, Oxford & IBH Publishing Co. New Delhi.
2. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, Tamil Nadu.
3. Sandhu, M.K., “Plant Propagation”, New Age International Publishers.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	14	24
3	10	16
Total	30	50

3.6.8 PHOTOGRAPHY

L	P
2	-

RATIONALE

Photography is a unique and creative medium of self-expression that requires aesthetic sense as well as technical expertise. Students who are highly passionate about learning the workings of cameras and different technologies based on them can pursue this course. The objective of this course is to enable the candidates to understand the utility of different camera parts and the art of taking candid shots.

LEARNING OUTCOMES

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

- Explain the principles of photography.
- Handle various cameras for taking photographs.
- Apply aesthetics of photography.

DETAILED CONTENTS

- | | | |
|----|-------------------|----------|
| 1. | Basic Photography | (04 hrs) |
|----|-------------------|----------|

Meaning and definition of photography, Basic principle in the film and digital photography, History of photography.

- | | | |
|----|---------------------------------|----------|
| 2. | Camera Function and Accessories | (04 hrs) |
|----|---------------------------------|----------|

Basic camera, Different parts of camera and their basic functions, Camera Accessories

- | | | |
|----|-------------------------|----------|
| 3. | Main Controls of Camera | (10 hrs) |
|----|-------------------------|----------|

Parts of Camera, Types of lenses, Shutter, Diaphragm, Exposure, Film and digital image sensor, Depth of field, Lighting, Photography with flash, Filters in photography.

4. Digital Camera (05 hrs)

Process of digital imaging, Types of digital cameras, Menu operations of digital cameras, Introduction to colors.

5. Aesthetics of Photography (07 hrs)

Definition of lighting, Principles of lighting, Reflection, Light characteristics, Color, Direct light and indirect light, Light and subject, Light as subject, Shadow as subject, Light sources, Natural light and artificial light, Principles of visualization, Composition guidelines

RECOMMENDED BOOKS

1. Dilwali, Ashok, "All about Photography", National Book Trust, New Delhi.
2. Sharma, O.P., "Practical Photography", Hind Pocket Books.
3. Freeman, "The Photographer's Guide to Light", John Collins & Brown

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	04	08
3	10	16
4	05	08
5	07	12
Total	30	50

3.6.9 LEGAL STUDIES

L	P
2	-

RATIONALE

The course introduces the students to Indian legal system, contracts management, and legal documentation. Further, the course familiarizes students with basic knowledge of labour laws that would be useful.

LEARNING OUTCOMES

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

- Understand the Indian Legal System.
- Discuss Indian Contract Act.
- Explore labour laws and laws related to women.

DETAIL CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction to Indian Legal System | (04 hrs) |
| | Constitution of India, Sources of Law and Judicial system. | |
| 2. | The Indian Contract Act | (06 hrs) |
| | Contract – meaning and kinds. Essentials of a valid contract, Discharge of a contract, Contract of Agency | |
| 3. | Legal Documentation | (10 hrs) |
| | Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and subcontracting | |

4. Labour Laws (06 hrs)

Provident Fund, ESIC, Gratuity and Bonus

5. Legislation Related to Women (04 hrs)

Sexual harassment at Work place (Prevention, Prohibition and Redressal), Protection of Women from Domestic Violence Act, Criminal Law (Amendment) Act, The Indecent Representation of Women (Prohibition) Act.

RECOMMENDED BOOKS

1. Joseph Minattur, “Indian Legal System”, Indian Law Institute, New Delhi.
2. Srivastava, S.C., “Industrial Relations and Labour Laws”, Vikas Publishing House Pvt. Ltd.
3. Aggarwal, S K, “Business Law”, Galgotia Publishers, Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	07
2	06	10
3	10	16
4	06	10
5	04	07
Total	30	50

3.6.10 EVENT MANAGEMENT

L	P
2	-

RATIONALE

Event Management is a course which deals with the planning, coordinating, and organising of events for people and communities. It is a part of the mass communication course which is offered by many prestigious colleges in India. Event management course aims to imbibe knowledge on analysing, marketing, planning and strategies in business administration to its students.

LEARNING OUTCOMES

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

- Explain the purpose of special events in an organization.
- Use techniques and strategies required to plan successful special events.
- Promote and conduct special events.
- Assess the quality and success of special events.

DETAILED CONTENTS

1. Principles of Event Management (04 hrs)

Introduction to event management, size & type of event, event team, code of ethics, principles of event management, role of event manager – planning, organising, leading and controlling an event

2. Event Planning (08 hrs)

Objective of event, use of planning tools, protocols, dress codes, staging, staffing.

3. Event Marketing (04 hrs)

Advertising, publicity, event marketing process, even hospitality

4. Event Leadership (06 hrs)

Teambuilding & work distribution, managing team, managing meetings, written & verbal communication.

5. Event Safety and Security (04 hrs)

Role of Security, Safety, Crowd management, Risk management.

6. Event Accounting (04 hrs)

Budget, Cash flow analysis, Profit & loss statement, Balance sheet.

RECOMMENDED BOOKS

1. Singla, Sita Ram, "Event Management", ATH Publishers, New Delhi.
2. Sharma, Divakar, "Event Planning and Management", Deep & Deep Publication.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	08	12
3	04	08
4	06	10
5	04	08
6	04	06
Total	30	50

3.6.11 DIET AND NUTRITION

L	P
2	-

RATIONALE

The objective of this course is to help the students to understand the concept of diet and nutrients and provide knowledge about causes and symptoms of Nutrition-related disorders.

LEARNING OUTCOMES

On completion of this course, the students will be able to:

- Comprehend the nutritional value of different food items.
- Explain the need of nutrition during the normal stages of life.
- Calculate normal dietary requirements and balanced diet.

DETAILED CONTENTS

1. Introduction (04 hrs)

Basic concepts of health, Nutrition, Nutrients, Nutrition requirement, Balanced diet. Relationship between health & nutrition, Assessment of nutritional status.

2. Nutrients (16 hrs)

Nutrients & their classification. Macro Nutrients –Sources, Functions and Effects on the Body; Micro nutrients - sources, Functions and effects on the Body; Fat soluble nutrients - sources, Functions and effects on the body, Water soluble nutrients - Sources, Functions and effects on the body, Digestion, Absorption of carbohydrates, Lipids, Proteins and energy.

3. Energy and Nutrition-related Disorders (06 hrs)

Basic concepts, Definition and components of energy requirement, Protein malnutrition, Iodine deficiency disorders, Disease and disorder caused by imbalance of nutrients, Food allergies.

4. Nutritional Needs (04 hrs)

Nutritional need during normal stages of life - Infancy, Childhood, Adolescence, Pregnancy, Lactation and Old age, Disease management with diet.

RECOMMENDED BOOKS

1. Antia, F.P., "Clinical Dietetics and Nutrition", Oxford University Press.
2. Swaminathan, "Essentials of Food and Nutrition", Ganesh and Co., Madras.
3. Subhangini Joshi, "Nutrition and Dietetics", McGraw Hill Publishers.
4. B.S. Narsinga Rao et al, "Nutritive Value of Indian Foods", National Institute of Nutrition, Hyderabad.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	16	28
3	06	10
4	04	06
Total	30	50

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

This is to be organized at a stretch for two to three days during third semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Drugs Use and Abuse in Society
 - b. Concept and overview
 - c. Extent of the problem
 - d. Drug use as a social problem
 - e. Causes of Drug Use: Biological, Socio-cultural, psychological
2. Types of Dugs and identification of Abuse
 - a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
 - b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
 - c. Reformance enhancing drugs
 - d. Uppers and Downers: Stimulants and Depressants
3. Impact of Drug Abuse
 - a. Individual level biological and psychological
 - b. Family social, National
4. Management and Prevention of Drug Abuse
 - a. Medical and psychological
 - b. Role of family School , Media and Legislation

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L P
3 -

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOMES

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

- Explain the importance of generic skills
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Conduct market survey and prepare project report.

DETAILED CONTENTS

1. Introduction to Generic Skills (04 hrs)
 - 1.1 Importance of Generic Skill Development
 - 1.2 Life Long Learning and associated importance of Generic Skill Development

2. Managing Self (07 hrs)
- 2.1 Knowing Self for Self Development
- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
- 2.2 Managing Self - Physical
Personal grooming, Health, Hygiene, Time Management
- 2.3 Managing Self – Intellectual development
- Information Search: Sources of information
 - Communication: Official & business correspondence, Job application covering letter and resume
- 2.4 Managing Self – Psychological
- Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage stress
3. Managing in Team (06 hrs)
- 3.1 Team - definition, team dynamics
- 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
- 4 Task Management (03 hrs)
- 4.1 Task Initiation, planning, execution, close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (05 hrs)
- 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
- 5.2 Different approaches for problem solving.
- 5.3 Steps followed in problem solving.
- 5.4 Exercises/case studies on problem solving.

6. Entrepreneurship (20 hrs)

6.1 Introduction

- Concept/Meaning and its need
- Qualities of an entrepreneur
- Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

6.2 Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yojana (PMMY) , Make in India, Start up India, Stand up India, National Urban Livelihood Mission (NULM); Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

6.3 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale unit/ industry
- Procedures for registration of small-scale unit /industry
- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection

6.4 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may

also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Balasubramanian, S., “Soft Skills for Interpersonal Communication”, Orient Black Swan, New Delhi.
2. “Lifelong learning”, Policy Brief (www.oecd.org).
3. Rathore, BS, and Dr JS Saini, “A Handbook of Entrepreneurship”, Aapga Publications, Panchkula (Haryana).
4. Gupta, CB, and P Srinivasan, “Entrepreneurship Development”, Sultan Chand and Sons, New Delhi.
5. “Entrepreneurship Development”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	04	06
2.	07	08
3.	06	06
4.	03	04
5.	05	06
6.	20	20
Total	45	50

4.2 COMMUNICATION SYSTEMS

L	P
3	2

RATIONALE

This course provides the basics of electronic communication systems including transmitters, receivers, antennas and various modes of signal propagation. In addition to components and systems of fiber optic communication, the students will learn the basics of satellite communication. This course will provide the students with perspectives of different communication systems.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Classify the transmitters on the basis of modulation, service, frequency and power.
- Demonstrate the working of each stage of AM and FM transmitters.
- Identify the waveforms at different stages of a Radio Receiver.
- Tune AM broadcast radio receiver.
- Measure the performance characteristics of a radio receiver (sensitivity, selectivity, fidelity, S/N ratio, image rejection ratio).
- Determine the appropriate value of Intermediate Frequency IF.
- Identify the waveforms at different stages of a FM receiver.
- Discover various types of antennas used in different frequency ranges.
- Plot the radiation pattern of directional and omni-directional antenna.
- Explain various modes of propagation of waves i.e. Ground Wave, Sky Wave, Space Wave and Duct Propagation.
- Plot the variation of field strength of a radiated wave, with distance from a transmitting antenna.
- Describe type of communications and communication protocols.

DETAILED CONTENTS

1.	AM/FM Transmitters	(08 hrs)
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- Classification of transmitters on the basis of modulation, service, frequency and

power

- Block diagram of AM transmitters and working of each stage
- Block diagram and working principles of reactance FET and armstrong transmitters

2. AM/FM Radio Receivers (12 hrs)

- Principle and working with block diagram of super heterodyne AM receiver.
- Function of each block and typical waveforms at input and output of each block
- Performance characteristics of a radio receiver: sensitivity, selectivity, fidelity, S/N ratio, image rejection ratio and their measurement procedure. ISI standards on radio receivers (brief Idea)
- Selection criteria for intermediate frequency (IF). Concepts of simple and delayed AGC
- Block diagram of an FM receiver, function of each block and waveforms at input and output of different blocks. Need for limiting and de-emphasis in FM reception

3. Antennas (10 hrs)

- Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF, Microwave.
- Concept of radiation of electromagnetic energy from a dipole.
- Concept of polarization of EM Waves.
- Definition and physical concepts of the terms used with antennas like point source, gain directivity, aperture, effective area, radiation pattern, beam width and radiation resistance, loss resistance.
- Types of antennas-brief description, characteristics and typical applications of half wave dipole, medium wave (mast) antenna, folded dipole.
- Structure, Characteristics and typical applications of Horn antenna and dish antenna.

4. Propagation (09 hrs)

- Basic idea about different modes of wave propagation and typical areas

of application. Ground wave propagation and its characteristics, summer field equation for field strength.

- Space wave communication – line of sight propagation, standard atmosphere, concept of effective earth radius range of space wave propagation standard atmosphere
- Duct propagation: sky wave propagation - ionosphere and its layers.
- Explanation of terms - virtual height, critical frequency, skip distance, maximum usable frequency, multiple hop propagation.

5. Types of Communication System (06 hrs)

- Block diagram of the Communication system
- Types of Communications (Wireless Communications, satellite communication, Optical Fibre communication)
- Communication Protocols (IEEE standard for wireless, Satellite and optical fiber communication)
- Various impairments in the communication system

LIST OF PRACTICAL EXERCISES

1. To observe the waveforms at different stages of a AM transmitter
2. To observe the waveforms at different stages of Armstrong transmitter.
3. To observe the waveforms at different stages of a Radio Receiver
4. To align AM broadcast radio receiver
5. Comprehend the operation of Superheterodyne receiver and measure the receiver parameters: sensitivity & selectivity
6. Study of Pre-emphasis and De-emphasis process in FM.
7. To identify and study the various types of antennas used in different frequency ranges.
8. To plot the radiation pattern of a directional and omni directional antenna
9. To plot the variation of field strength of a radiated wave, with distance from a transmitting antenna.
10. Fabricate wireless remote transmitter and receiver as is used in common toys and verify its operation.

NOTE: Visits to appropriate sites of digital/data communication networks, satellite communication, telemetry centers (like remote sensing) should be made with a view to

understand their working. A comprehensive report must be prepared by all students on these visits, especially indicating the dates and locations of their visits.

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. G., Kennedy, & Davis B., “Electronic Communication Systems”, Tata McGraw Hill Education Pvt Ltd., Glencoe Publishers.
2. Taub, H, & D. Schilling, “Principles of Communication Systems”, Gautam Sahe, TMH.
3. Singh, and Sapre, “Communication Systems: Analog and Digital”, TMH.
4. Prasad, K.D., “Antenna and Wave propagation”, Satya Prakashan.
5. Balanis, C.A., & John Wiley, “Antennas Analysis & Design”.
6. Jordan, E.C . & K.G. Balmin, “Electromagnetic Waves”, PHI.
7. Collin, Robert E., “Antenna & Wave Propagation”, McGraw Hill.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	08
2	12	14
3	10	12
4	09	09
5	06	07
Total	45	50

4.3 INDUSTRIAL ELECTRONICS

L	P
2	4

RATIONALE

Students of Electronics and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further reinforce the knowledge and skill of the students.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Describe the construction, working principles of SCR, two transistor analogy of SCR, SCR specifications, methods of SCR triggering.
- Plot and explain V-I characteristics of SCR, TRIAC, UJT, DIAC
- Demonstrate I/P and O/P wave forms of UJT relaxation oscillator
- Draw the wave shape of voltage at relevant point of single-phase controlled rectifiers (half wave, full wave) and effect of change of firing angle.
- Demonstrate wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit
- Install UPS system and routine maintenance of batteries
- Handle the working of choppers, inverters, dual converters, and cyclo-converters.

DETAILED CONTENTS

1. Introduction to Thyristors and other Power Electronics Devices (08 hrs)
 - Construction, working principles of SCR, two transistor analogy of SCR, V-I characteristics of SCR.
 - SCR specifications & ratings.
 - Different methods of SCR triggering.
 - Construction & working principle of DIAC, TRIAC & their V-I characteristics.
 - Construction, working principle of UJT, V-I characteristics of UJT. UJT

as relaxation oscillator.

- Basic idea about the selection of Heat sink for thyristors.
- Application such as light intensity control, speed control of universal motors, fan regulator, battery charger.

2. Controlled Rectifiers (07 hrs)

- Single phase half wave controlled rectifier with load (R, R-L)
- Single phase half controlled full wave rectifier (R, R-L)
- Fully controlled full wave bridge rectifier.
- Single phase full wave center tap rectifier.

3. Inverters, Choppers, Dual Converters and Cyclo-converters. (10 hrs)

- Principle of operation of basic inverter circuits, concepts of duty cycle, series
- & parallel. Inverters & their applications.
- Choppers: Introduction, types of choppers (Class A, Class B, Class C and
- Class D). Step up and step down choppers.
- Dual Converters and cyclo-converters: Introduction, types & basic working principle of dual converters and cyclo-converters & their applications.

4. Uninterrupted Power supplies (05 hrs)

- UPS, on-line, off line & its specifications
- Concept of high voltage DC transmission
- Concept of SMPS

LIST OF PRACTICAL EXERCISES

1. To plot VI characteristic of an SCR.
2. To plot VI characteristics of TRIAC.
3. To plot VI characteristics of UJT.
4. To plot VI characteristics of DIAC.
5. Study of UJT relaxation oscillator and observe I/P and O/P wave forms
6. Demonstrate of wave shape of voltage at relevant point of single-phase half wave

- controlled rectifier and effect of change of firing angle.
7. Demonstrate of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
 8. Demonstrate of wave shapes and measurement of voltage at relevant points in
 9. TRIAC based AC phase control circuit for.
 10. Study of a single-phase cyclo converter.
 11. Study of any chopper circuit to check the performance
 12. Study of varying lamp intensity and AC fan speed control.
 13. Installation of UPS system and routine maintenance of batteries.
 14. Speed control of motor using SCRs

INSTRUCTIONAL STRATEGY

Industrial Electronics being very important for industrial controls requires a thorough know how about industrial devices. Teacher should take to the class various SCRs and other semiconductor devices to demonstrate these to the students. The teacher may encourage students to perform practical simultaneously for better understanding of the subject and verification of theoretical concepts. So industrial visit in between the course is a must.

RECOMMENDED BOOKS

1. M. H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India.
2. Umanand, L., “Power Electronics: Essentials and Applications”, Wiley India.
3. Erickson, R. W., and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media.
4. Mohan, N., and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons.
5. Rashid, MH, “Power Electronics Devices, Circuits and Applications”, Pearson.
6. Berde, M.S., “Power Electronics”, Khanna Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	12
2	07	10
3	10	20
4	05	08
Total	30	50

4.4 MICROCONTROLLERS AND EMBEDDED SYSTEM

L	P
3	4

RATIONALE

Micro-controllers and Embedded systems are of great significance in the electronic and consumer goods industry and play very important role. This subject aims to expose students to the embedded systems besides giving them adequate knowledge of Micro controllers. This subject will help the students to write the program for microcontrollers. It will also help the students to interface various devices with microcontroller and to develop an embedded system.

LEARNING OUTCOMES

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

- Perform experiments on a microcontroller kit
- Describe architecture, instruction set and addressing modes of 8051 microcontroller
- Understand the working of Arduino Board
- Programming concept of Arduino
- Develop an embedded system using Arduino

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Microcontroller series (MCS) – 51 Overview | (10 hrs) |
| | <ul style="list-style-type: none"> • Architecture of 8051 Microcontroller • Pin details • I/O Port structure • Memory Organization • Special Function Registers (SFRs) External Memory | |
| 2. | Instruction Set: Addressing Modes, Instruction types | (08 hrs) |
| | <ul style="list-style-type: none"> • Addressing Modes of 8051 | |

- Instruction types of 8051
 - Interrupts
3. Introduction to Arduino Board (10 hrs)
- Basic introduction to the Arduino
 - Technical specifications, Pin details
 - Accessories, and applications
 - Basic introduction to the Arduino Microcontroller
4. Programming Concepts of Arduino: (10 hrs)
- Understanding and Using Variables, If-Else Statement,
 - Comparison Operators and Conditions, For Loop Iteration, Arrays, Switch Case Statement and Using a Keyboard for Data Collection, While Statement, Using Buttons,
 - Reading Analog and Digital Pins, Serial Port Communication
 - Concepts of sensors, their technical specifications, selection criterion, working principle and applications such as IR sensors, ultrasonic sensors.
 - Introduction programming of different type of sensors and communication modules, DC Motors Driver L298N controlling.
5. Introduction to Embedded System (07 hrs)
- Features, Advantages and Disadvantages of Embedded System,
 - Need of open source Hardware and Software (Arduino) in developing Embedded System.
 - Introduction to ESP-32 Microcontroller

LIST OF PRACTICAL EXERCISES

1. Demonstration of Micro-controller Kit
2. Demonstration of Arduino Board: Technical specifications, accessories
3. Using open source Hardware and Software (like Arduino) to interface Sensor (IR/Ultrasonic / Temperature/ Pressure/ Touch)
4. Using open source Hardware and Software (like Arduino) to interface LCD (16X2).
5. Using open source Hardware and Software (like Arduino) to interface

6. Motor Driver/ servomotor.
7. Adding WIFI to open source Hardware and Software (like Arduino).
8. Using open source Hardware and Software (like Arduino) to interface Bluetooth module.
9. Projects on embedded system using Arduino board

INSTRUCTIONAL STRATEGY

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 and micro-controller operations may be identified and given to students as assignments.

RECOMMENDED BOOKS

1. Deshmukh, Ajay V, “Microcontroller Theory and Applications”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Ayala, “The 8051 Micro Controller 3rd Edition Microcontrollers”, Penram International Publishing.
3. Mazidi, “Microcontrollers”, Pearson Education, Delhi.
4. Sangar, and Sahdev, “Microcontrollers and Embedded Systems”, Uneek Publications, Jalandhar.
5. Kamal, Raj, “Embedded Systems- Architecture, Programming and Design”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	10	12
2.	08	08
3.	10	12
4.	10	12
5.	07	06
Total	45	50

4.5 ELECTRONICS DESIGN AND SIMULATION TECHNIQUES

L	P
-	4

RATIONALE

The purpose of this subject is to give practice to the students in elementary design and fabrication of the PCB. The topics of assembly, soldering, testing, and documentation have been included to give overall picture of the process of manufacturing of electronic circuits.

LEARNING OUTCOMES

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

- Demonstrate skills in assembly of components, soldering, and desoldering techniques
- Design of circuit using Free and Open Source Software based EDA Tools
- Perform drilling, photo-processing
- Fabrication of PCB using Analog and Digital Circuits

PRACTICAL EXERCISES

1. Electronic Design

Selection and use of commonly used active and passive components

Testing of active and passive components

Develop skills in assembly of components, soldering, and soldering techniques

2. Printed Circuit Board (PCB)

Introduction: What is PCB, Types of PCBs: Single/Double Sided and Multi-Layer PCBs, PCB Layer Masks: Top Layer Mask, Bottom Layer Mask, Solder Mask, Legend Print or Silk screen Mask, Hand-Taping Vs CAD

PCB Materials: FR-2 and FR-4 material advantages and disadvantages, PCB Design Rules.

3. Computer Aided Design Simulation using EDA Tools

Latest Trends in Market, Need of EDA Tools, Working with EDA Tools like Circuit Maker/EAGLE/Any other Free Open Source Software, Schematic Design, Net list creation, Electrical Rule Check (ERC), PCB Layout Design, Auto and Manual Routing, Design Rule Check (DRC), Creating Library, Creating component, Symbols and Footprints for components.

4. PCB Fabrication

Photo Processing for Pattern Transfer, Etching, Drilling, Component Mounting, Soldering and De-soldering, PCB Testing, PCB design and fabrication of Analog and Digital Electronic Circuits.

INSTRUCTIONAL STRATEGY

More emphasis may be laid on practicals. Small industrial problems may be taken as assignments. Practical training regarding fabrication techniques using CAD may be carried out.

RECOMMENDED BOOKS

1. Bosshart, “Printed Circuit Board”, McGraw Hill Education Pvt Ltd., New Delhi.
2. Khandpur, RS, “Printed Circuit Board”, Tata McGraw Hill Education Pvt Ltd., New Delhi.
3. Mehra, Dr. Rajesh, “Module on CAD for PCBs using EAGLE Software”, Professor, NITTTR, Chandigarh.
4. Jamwal, KS, “Electronic Manufacturing Technology”, Dhanpat Rai and Sons, New Delhi.

4.6 MINOR PROJECT

L P
- 6

RATIONALE

Minor 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 minor 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 by undertaking a project.
- 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 first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the 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 work, they would like to execute. The activity of problem identification should begin well in advance. Students should be allotted a problem of interest to him/her. 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 in a group. The project work identified in collaboration with industry should be preferred.

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

The projects given to students should be such for which some one is waiting for solution. Some of the suggested project activities are given below:

1. Projects based on the use of transducers in measurement and control.
2. Projects to fabricate and test circuits of various types of modulators and demodulators.
3. Projects to fabricate and test circuits of various arithmetic circuits.
4. Projects to fabricate and test circuits of various multiplexers/ demultiplexers.
5. Projects to fabricate and test circuits of various shift registers and counters.
6. Projects to fabricate and test circuits of various types of multistage amplifiers and compare their frequency response/ bandwidth.
7. Projects to fabricate and test circuits of various types of oscillators.
8. Projects to fabricate and test circuits based on operational amplifiers.
9. Projects to fabricate and test circuits based on 555 timer.
10. Projects to fabricate and test circuits to control various motors like stepper motor.
11. Projects that use optical fiber to transmit signal along with optical source and detector.
12. Projects to fabricate and test circuits of choppers and converters.
13. Projects to fabricate and test circuits based on SCR, DIAC, TRIAC and UJT.
14. Projects related to designing small electronic equipment / instruments.
15. Projects related to design of PCBs.
16. Projects related to suggesting substitutes of electronics components being used.

EVALUATION OF STUDENTS FOR MINOR PROJECT

The criteria for evaluation of minor project work is as follows :

Criteria	Weightage
Punctuality and Regularity	10 %
Planning and Execution	30%
Initiative in learning new things	10%
Report Writing	20%
Presentation and Viva	30%

Note :

A viva voce examination will be conducted at the end of minor project for assessing the work of student. The examination Committee for this purpose will consist of a professional and the teacher who has guided the project.

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

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

INDUSTRIAL TRAINING OF STUDENTS

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 a minimum of 6 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. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have 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) | Relationship with workers | 15% |
| d) | Industrial training report | 55% |

5.1 AUDIO VIDEO SYSTEMS

L	P
2	4

RATIONALE

The objective of this subject is to give students an in depth knowledge of various electronic audio, video devices and systems. Further this subject will introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices. It will help in developing required capabilities of assembling, fault diagnosis and rectification in a systematic way.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Explain the working of loudspeakers and microphones.
- Describe the basics of digital audio signals.
- Define the working of colour television system (PAL).
- Use the basic principles of digital video and its compression techniques.
- Illustrate basic techniques of digital television transmission and reception.
- Compare the working of LCD, LED, HDTV and plasma screen television.
- Test color TV using pattern generator

DETAILED CONTENTS

- | | | |
|------|---|----------|
| 1. | Introduction to Audio and Video Systems | (13 hrs) |
| 1.1. | Microphones and Loudspeakers | |
| | - Carbon, moving coil, cordless microphone | |
| | - Direct radiating and horn loudspeaker | |
| | - Multi-speaker system | |
| 1.2. | Digital Audio Fundamentals | - |
| | - Audio as Data and Signal, Digital Audio Processes Outlined, | |
| | - Time Compression and Expansion. | |

1.3 Basics of Television

- Elements of TV communication system
- Scanning and its need
- Composite Video Signal
- Primary, secondary colours, Concept of Mixing, Colour Triangle
- PAL TV Receiver

2. Digital Video, Compression Techniques and Standards (04 hrs)

Digital Video, The RGB and YUV Representation of Video Signals, The Need for Compression, Introduction to compression formats for video - MPEG-x format, H.26x format

3. Digital Television-Transmission and Reception (05 hrs)

Digital satellite television, Direct-To-Home (DTH) satellite television, Digital TV receiver, Merits of digital TV receivers, Digital Terrestrial Television (DTT), Introduction to: Video on demand, CCTV, CATV with optical fibre.

4. Liquid Crystal and Plasma Screen Televisions (06 hrs)

LCD technology, LCD matrix types and operation, LCD screens for television, Plasma and conduction of charge, Plasma television screens, Signal processing in Plasma TV receivers, A Plasma colour receiver, LCD colour receivers, Single LCD receivers, 3-LCD colour receivers, Performance comparison of Plasma and LCD televisions, Introduction to LED TV, RGB dynamic LEDs, Edge-LEDs, Differences between LED-backlit and Backlit LCD displays, Comparison of Plasma TV and LED TV, Introduction to OLED TVs.

5. Introduction to Projection Display Systems and Television Home Theaters. (02 hrs)

LIST OF PRACTICAL EXERCISES

1. To plot the directional response of a microphone
2. To plot the directional response of a loud speaker.
3. Identify different components and section in TV receiver (B/W)
4. Identify different components and section in TV receiver (Colour)

5. Voltage and waveform measurements of signal at various points in a television circuit.
6. To test color TV using pattern generator.
7. To perform fault identification in Colour TV.
8. Installation of DTH System.
9. To identify different sections of LCD television receiver.
10. To identify different sections of LED television receiver.
11. To identify the ports and installation of Projection display systems.

INSTRUCTIONAL STRATEGY

This subject provides information to the students regarding audio video systems. Emphasize should be made in the laboratory on the conduct of experiments.

RECOMMENDED BOOKS

1. Gulai, R. R., “Modern Television Practice (Multi Colour Edition)”, New Age International Publishers.
2. Gupta, R. G., “Audio Video Systems”, McGraw Hill Education System.
3. Khan, Imran Ashraf, “Practical LCD/LED TV Training Course”, Saz Publications.
4. Bali & Bali, “Audio Video Systems Principles Practices and Troubleshooting”, Khanna Publishing Company.
5. Bali, S. P., “Consumer Electronics”, Pearson Education, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	13	12
2	04	10
3	05	10
4	06	10
5	02	08
Total	30	50

5.2 OPTICAL FIBER COMMUNICATION

L	P
2	4

RATIONALE

Progressing from communication over copper wire to today's fibre optic communication, we have increased our ability to transmit more information, more quickly and over longer distances. This has expanded our boundaries and is finding a good slot in communication system. Optical fibers have replaced existing transmission media due to its advantages. As a result the students are supposed to have knowledge of optical communication. This subject will provide required basic concepts, requisite knowledge and skills.

LEARNING OUTCOMES

After completion of the course, the learner should be able to:

- Set up a fibre analog link and optic digital link.
- Measure bending losses in optical fibers.
- Calculate the splice or connector loss.
- Measure numerical aperture of optical fiber.
- Explain and demonstrate characteristics of optical source and optical detector.
- Connect a fiber with connector at both ends.
- Identify and demonstrate use of various components and tools used in optical fiber communication.

DETAILED CONTENTS

- | | | |
|----|--------------|----------|
| 1. | Introduction | (06 hrs) |
|----|--------------|----------|
- Historical perspective, basic communication systems, optical frequency range, advantages of optical fibre communication, application of fibre optic communication.
 - Electromagnetic spectrum used, Advantages and disadvantages of optical communication.
 - Principle of light penetration, reflection, critical angle.

2. Optical Fibers and Cables (05 hrs)

- Constructional details of various optical fibers, multimode and mono-mode fibers, step index and graded index fibers, acceptance angle and types of optical fiber cables.
- Optical Fibers cable connectors and splicing techniques (Mechanical, fusion)

3. Losses in Optical Fiber Cable (04 hrs)

- a) Absorption Losses: Scattering Losses, Radiation Losses, Connector losses, Bending losses.
- b) Dispersion: Types and its effect on data rate.
- c) Testing of losses using OTDR (Optical Time Domain Reflectometer).

4. Optical Sources (05 hrs)

Characteristics of light used in optical communication, principle of operation of LED, different types of LED structures used and their brief description, Injection laser diode, principle of operation, comparison of LED and ILD.

5. Optical Detectors (02 hrs)

Characteristics of photo detectors used in optical communication; PIN diode and avalanche photo diode (APD), Noise in detectors.

6. Optical Amplifiers (04 hrs)

Types of optical amplifiers, semiconductor & fiber optical amplifiers
Functional types, principle of operation of Semiconductor Optical Amplifiers (SOA), types of SOA. SOA applications, advantages, Drawbacks, Fabry Perot Amplifier (FPA), Travelling Wave Amplifier (TWA), Erbium Doped Fiber Amplifier (EDFA), Raman amplifiers.

7. Optical Fiber System Application (04 hrs)

FTTx (Fiber to the x, NGN (Next Generation Network), NFS (Need for Spectrum), IOT (Internet of Things), Apparel Technology.

LIST OF PRACTICAL EXERCISES

1. Setting up of fiber analog link
2. Setting up of optic digital link
3. Measurement of bending losses in optical fibers
4. To test the losses using optical time domain reflectometer
5. To observe and measure the splice or connector loss
6. To measure and calculate numerical aperture of optical fiber
7. To observe characteristics of optical source
8. To observe characteristics of optical detector
9. To splice the available optical fiber
10. To connect a fiber with connector at both ends
11. Demonstration of various components and tools used in optical fiber communication

INSTRUCTIONAL STRATEGY

This subject gives the complete knowledge of optical fibre communication techniques. The teacher should make the students aware about the historical development, optical sources and optical fibre system in addition to applications of optical fibre in communication system. Since this subject deals with theory and practical, the theory should be re-enforced by visit to sites and industries like HFCL having optical fiber installations in addition to practical work in the laboratory.

RECOMMENDED BOOKS

1. Gupta, S.C., “Textbook on Optical Fiber Communication and its Applications”, PHI Publishers.
2. Senior, John M., “Optical fiber Communication”, Prentice Hall of India, New Delhi.
3. Gower, J., “Optical fiber Communication”, Prentice Hall of India, New Delhi.
4. Keiser, Gerd, “Optical fiber Communication”, McGraw Hill International Editions.
5. Sangar, and Sahdev, “Optical Fiber Communication”, Uneek Publications, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	05	08
3	04	07
4	05	08
5	02	05
6	04	06
7	04	06
Total	30	50

5.3 DIGITAL COMMUNICATION

L	P
2	4

RATIONALE

This subject deals with the advanced digital and data communication techniques beyond the conventional communication. It involves the use of modems in synchronous and asynchronous data transmission. It encompasses the modern communication network and integrated services like ISDN and Radio paging along with cellular mobile telephones, FAX, electronic exchanges etc. so vital for present day communication.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Describe and identify block diagram of digital and data communication link.
- Demonstrate and explain different coding schemes (5-bit Baudot, 7-bit ASCII, ARQ, EBCDIC) and error detecting and correcting techniques (redundancy, parity, Cyclic Redundancy Check, Hamming code)
- Transmit Hamming code on a serial link and reconvert at the receiving end
- Plot and interpret wave forms at input and output of ASK and FSK modulators
- Define Space and time switching systems.
- Understand different types of Pulse Modulation Techniques (PAM, PPM, PWM, PCM) and Delta Modulation

DETAILED CONTENTS

- | | | |
|----|--------------|----------|
| 1. | Introduction | (02 hrs) |
|----|--------------|----------|

Basic block diagram of digital and data communication systems. Their comparison with analog communication systems.

- | | | |
|----|--------|----------|
| 2. | Coding | (06 hrs) |
|----|--------|----------|

- | | |
|----|--|
| a) | Introduction to various common codes 5 bit Baudot code, 7 bit ASCII, ARQ, EBCDIC |
|----|--|

- b) Code error detection and correction techniques - Redundancy, parity, Cyclic Redundancy check (CRC), Hamming code
3. Digital Modulation Techniques (06 hrs)
- Basic block diagram and principle of working of the following:
 - Amplitude shift keying (ASK): Interrupted continuous wave (ICW), two tone modulation
 - Frequency Shift keying (FSK)
 - Phase shift keying (PSK), Quadrature Phase Shift Keying (QPSK)
4. Data Transmission (06 Hrs)
- Characteristics/working of data transmission circuits; bandwidth requirements, data transmission speeds, noise, cross talk, echo suppressors, distortion, equalizers
5. Pulse Modulation (10 hrs)
- Statement of sampling theorem and elementary idea of sampling frequency for pulse modulation
 - Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM)
 - Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM).
 - Pulse code Modulation (PCM): Basic scheme of PCM system, Quantization, Quantization Error. Advantages of PCM systems. Concepts of differential PCM (DPCM)
 - Delta Modulation (DM): Basic principle of delta modulation system, advantages of delta modulation system over PCM system. Limitations of delta modulation, concept of adaptive delta modulation (ADM)

LIST OF PRACTICAL EXERCISES

1. Transmission of Hamming code on a serial link and its reconversion at the receiving end.
2. Observe wave forms at input and output of ASK and FSK modulators with the help of CRO

3. Observe wave forms at input and output of QPSK modulators
4. Observe wave forms at input and output of PSK modulators
5. To observe the sampled signal and compare it with the analog input signal. Note the effect of varying the sampling pulse width and frequency on the sampled output.
6. To observe and note the pulse amplitude modulated signal (PAM) and compare them with the corresponding analog input signal
7. To observe PPM and PWM signal and compare it with the analog input signal
8. To feed an analog signal to a PCM modulator and compare the demodulated signal with the analog input. Also note the effect of low pass filter at the demodulated output.
9. To observe waveforms at various points of the delta modulator.
10. To observe waveforms at various points of the delta demodulator.

INSTRUCTIONAL STRATEGY

This subject provides information to the students regarding the various techniques used in Digitals and Data Communication. Emphasize should be made in the laboratory on the conduct of experiments. For the better awareness, visit must be arranged to the industries like telephone exchange, various cellular industries etc.

Visits to the sites of all types of telephone exchanges (including mobile and rural exchanges), Carrier telephony should be made with a view to understand their working. A comprehensive report must be prepared by all the students on these visits, especially indicating the dates and locations of their visits.

RECOMMENDED BOOKS

1. Kennedy, George, "Electronic Communication Systems", Tata McGraw Hill Education Pvt. Ltd, New Delhi.
2. Gautam, A.K., "Communication System", S.K. Kataria Sons, Delhi.
3. Jamwal, K.S., "Electronics Communication", Dhanpat Rai and Sons, Delhi.
4. Jamwal, KS, "Electronics Communication", Dhanpat Rai and Co, New Delhi.
5. Singh, Anokh, "Principles of Communication Engineering", S.Chand and Co., New Delhi.
6. Roody, Dennis, and John Coolen, "Principles of Communication Engineering", Prentice Hall.

SUGGESTED DISTRIBUTION OF MARKS:

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	02	04
2	06	10
3	06	10
4	06	10
5	10	16
Total	30	50

5.4 PLCs and SCADA

L	P
2	4

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know about the basics of Programmable Logic Controllers, their working and their programming. PLCs are widely used in all industries for efficient automatic control operations. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Explain and demonstrate the different modules of a Programmable Logic Controller
- Program a PLC using a hand-held programmer and computer interface
- Implement ladder programming concepts
- Design basic logic operations using ladder programming
- Program a PLC for a specific application
- Explain the difference between DCS and SCADA.
- Demonstrate the programming of SCADA through some software.

DETAILED CONTENTS

1. Introduction to PLC (08 hrs)

Concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer, Input and Output Modules-Analog and Digital, PLC selection criteria.

2. Working of PLC (07 hrs)

- Basic operation and principles of PLC
- Scan Cycle

- Memory structures, I/O structure
 - Programming terminal, power supply
3. Instruction Set (05 hrs)
- Basic instructions like latch, master control self holding relays.
 - Timer instruction like retentive timers, resetting of timers.
 - Counter instructions like up counter, down counter, resetting of counters.
 - Arithmetic Instructions (ADD, SUB, DIV, MUL etc.)
 - MOV instruction
 - RTC (Real Time Clock Function)
 - Watch Dog Timer
 - Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal
 - Programming based on basic instructions, timer, counter, and comparison instructions using ladder program.
4. DCS Concepts (05 hrs)
- Concept of DCS, DCS I/O hardware, Remote Terminal Unit
5. SCADA (05 hrs)
- Block Diagram of SCADA, Difference between Open Architecture and Dedicated System. Difference between DCS and SCADA.
 - Introduction to SCADA software like RS VIEW etc.
 - PLC based SCADA Systems.

LIST OF PRACTICAL EXERCISES

1. Demonstration of Components/sub-components and modules of a PLC.
2. Demonstration of ladder diagram programming.
3. Write a ladder diagram program for Logic gates like AND, OR, NOT, XOR, NAND, NOR, XNOR.
4. Write and execute a ladder diagram program to implement arithmetic instructions.
5. Write and execute a ladder diagram program to implement comparison instructions.
6. Write and execute a ladder diagram program to implement timer instructions.

7. Write and execute a ladder diagram program to implement counter instructions.
8. Write and execute a ladder diagram program to implement MOV instructions.
9. Write a ladder diagram program for traffic light control.
10. Write a ladder diagram program for industry process control.
11. Write a ladder diagram program for water level control.
12. Write a ladder diagram program for automatic car parking.
13. Write a ladder diagram program for lift control.
14. Show online videos to demonstrate the development of animated graphics for various applications using SCADA.

INSTRUCTIONAL STRATEGY

Introduce the subject and make the students familiar with applications of PLCs. The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work.

RECOMMENDED BOOKS

1. Otter, Job Dan, “Programmable Logic Controller”, P.H. International, Inc, USA.
2. Dunning, Gary, “Introduction to PLCs”, McGraw Hill.
3. Mehra, Rajesh, and Vikrant Vij, “PLCs & SCADA Theory and Practices”, Laxmi Publication, Delhi.
www.amazon.in/PLCs-SCADA-Practice-Rajesh-Mehra-ebook/dp/B07568SYLK
4. Kaur, Gurpreet, and SK Sahdev, “Programmable Logic Controller and Microcontrollers”, Uneek Publications, Jalandhar.
5. Liptak, G, “Instrument engineers Handbook - Process Control, Modern Control Techniques for Process Industries”.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1.	08	10
2.	07	15
3.	05	15
4.	05	5
5.	05	5
Total	30	50

5.5 INDUSTRY 4.0 (PART I)

L	P
2	-

RATIONALE

This subject will play an important role in understanding the basic concepts related to industry 4.0. It will help the students to acquire elementary knowledge about various fields of Industry 4.0 like Internet of Things, Artificial Intelligence, Big Data Analytics, Cyber Physical System, Block Chain, Augmented and Virtual Reality. It will further give exposure to the students about introduction of 5G Communication.

LEARNING OUTCOMES

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

- Explain the elements of Industry 4.0.
- Describe the benefits of adopting Industry 4.0.
- Understand the components of 5 G network.
- Apply the concept of 5 G networks to industry.

DETAILED CONTENTS

- | | | |
|----|--|---------|
| 1. | Introduction, History, Evolution of Industry 4.0 | (2 hrs) |
| 2. | Technologies in Next Generation Industry 4.0 Environment | (4 hrs) |
| 3. | Elements of Industry 4.0 | (9 hrs) |

Internet of Things (IoT): Introduction and concept

Artificial Intelligence (AI): Introduction and Branches of AI

Big data analytics: Introduction to data science and big data

Cyber-Physical systems (CPS): CPS in real world

Augmented and Virtual Reality: Concept, difference between AR and VR

Blockchain: Concept

4. Benefits of adopting Industry 4.0 (3 hrs)

Interoperability, Transparency and consistency, Programmability, Decentralization, Tokenomics.

5. 5G in Industry 4.0 (6 hrs)

5G Industry Progress,

5G Network Challenges: Frequency Bands and spectrum, Huge Data Volume, Complexity of MIMO, Beamforming, Ultra Low Latency Service, Ultra Reliability, Security, Upgradation of user end devices, 5G network deployment,

5G Network Transformation:-Higher speed and greater bandwidth, Scalable and Agile network elements, Flexible networks

6. 5G Industry Applications (6 hrs)

5G Service Transformation: Introduction and uses of Enhanced Mobile Broadband, (IoT), Critical Internet of Things (IoT),

Industry Application- Live broadcast, Smart Power Grid, Smart City,

Security:-Introduction, DoS (Denial of Service) and DDoS (Distributed Denial of Service), Security Recommendations by ITU-T, Security Threats and Recommendations by NGMN

Business: Remote expertise, Automation with robots and cobots, Defect monitoring with machine vision, Predictive maintenance, Automated Guided vehicles (AGVs) and automated mobile robots (AMRs) for manufacturing.

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on conceptual understanding of elements of Industry 4.0 and 5G network. Experts may be invited to deliver lectures and share experiences.

RECOMMENDED BOOKS

1. R. Vannithamby and S. Talwar, "Towards 5G: Applications, Requirements and Candidate Technologies", John Wiley & Sons, West Sussex.
2. Manish, M., Devendra, G., Pattanayak, P., "5G and Beyond Wireless Systems : PHY Layer Perspective", Springer Series in Wireless Technology

3. Kuno Pfister, "Getting Started with IoT", O Reilly Media.
4. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education.
5. Ethem Appaydin, "Introduction to Machine Learning", PHI Learning.
6. F. Provost and T. Fawcett, "Data Science for Business", O'Reilly Media.
7. Kumar Sourav and Ashutosh Saxena, "Block Chain Technology", Wiley Publishers.
8. Schmalstieg and Hollerer, "Augmented Reality: Principles & Practice", Pearson Education India, ISBN-10: 9332578494
9. Steven M. LaValle, "Virtual Reality", Cambridge University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	04
2	4	06
3	9	15
4	3	05
5	6	10
6	6	10
Total	30	50

5.6.1 MEDICAL ELECTRONICS

L	P
3	-

RATIONALE

A large number of electronic equipment's are being used in hospitals for patient care and diagnosis to carry out advanced surgeries. This subject will enable the students to learn the basic principles of different instruments used in medical science. It will further give exposure to the students about recorders and monitoring systems.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Describe various medical electronics equipment and their uses.
- Use electrodes for various purposes.
- Classify the transducers and use them.
- Prepare block diagrams of biomedical recorders i.e. ECG, EEG and EMG Machines.
- Maintain various electronics patient monitoring systems.
- Measure current leakage with the help of safety analyzer.

DETAILED CONTENTS

1. Fundamentals of Medical Instrument (05 hrs)

Overview of Bio-Instrumentation in Hospitals., Sources of Biomedical Signals. Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG , EEG, Block Diagram of a Basic Medical Instrument system.
2. Basic Transducers (10 hrs)

Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor.

3. Bio-Medical Recorders (10 hrs)

Block diagram description and application of following instruments:

- ECG Machine
- EEG Machine
- EMG Machine.

4. Patient Monitoring Systems (10 hrs)

- Heart rate measurement Pulse
- Rate measurement Respiration
- Blood pressure measurement
- Blood Glucose level using Glucometer
- Measure sO₂ using a pulse oximeter
- Principles of defibrillator and pace mark

5. Safety Aspects of Medical Instruments (10 hrs)

- Gross current shock
- Micro current shock
- Special design from safety consideration.
- Safety standards

INSTRUCTIONAL STRATEGY

The teacher has to play a proactive role in arranging visits to hospitals and well equipped laboratories to reinforce theory. The apparatus and equipment available should be shown to students so that they can understand where and how the various biomedical instruments are used. Various charts and models be used for demonstration. Exposure to Spectrometer and UV Spectrometer must be given to students in addition to arranging visits to biomedical industries. Students must be taken for a visit to hospital for exposure of various medical electronics related equipment like ventilator, boyles apparatus, pulse ox meters, defibrillators, bedside monitor and x-ray equipment etc.

RECOMMENDED BOOKS

1. Khandpur, RS, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Cromwell, “Biomedical Instrumentation”.
3. Khandpur, RS, “Modern Electronics Equipment”, TMH, New Delhi.
4. Perkstein, Edward J., “Introduction to Biomedical Electronics”, Howard Bj, USA.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1	05	06
2	10	11
3	10	11
4	10	11
5	10	11
Total	45	50

5.6.2 IC FABRICATION

L P
3 -

RATIONALE

This subject includes an exposure to wafer cleaning and fabrication. This subject will help the students to study about different steps for IC fabrications along with different instruments used for fabrication process. It will develop IC fabrication competencies among the students which are required in the areas of sensors, MEMS and semiconductor devices.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Define cleaning process of wafers and crystal growth.
- Understand the oxidation processes of IC fabrication.
- Perform etching and wet and dry process.
- Describe Diffusion and Ion Implantation.
- Explain IC testing and packaging.

DETAILED CONTENTS

- | | | |
|---|---|----------|
| 1 | Historical perspective, processing overview, crystal growth, wafer fabrication and basic properties of Silicon Wafers | (07 Hrs) |
| 2 | Clean Rooms, Wafer Cleaning, Epitaxy, Thermal Oxidation of Silicon, Lithography | (12 Hrs) |
| 3 | Wet and Dry Etching, Thin film deposition, Diffusion, Ion Implantation | (07 Hrs) |
| 4 | Metallization, Process Integration: Passive components, Bipolar Technology, MOSFET Technology, MESFET Technology, MEMS Technology | (12 Hrs) |
| 5 | IC Manufacturing: Electrical Testing, Packaging, Yield, Future trends and Challenges: Challenges for integration, system on chip. | (07 Hrs) |

RECOMMENDED BOOKS

1. May, G. S., and S. M. Sze, "Fundamentals of Semiconductor Fabrication", Wiley India.
2. Plummer, J. D., M. D. Deal and P. B. Griffin, "Silicon VLSI Technology, Fundamentals, Practice and Modeling", Pearson Education.
3. Raj, Balwinder, Balwinder Singh, and Ashish Dixit, "VLSI Design and Fabrications" University Science Press, New Delhi, India.
4. S. M. Sze, "VLSI Technology", TMH.
5. S. M. Sze, "Semiconductor Devices: Physics and Technology", Wiley India.
6. Runyan, W. R., and K. E. Bean, "Semiconductor Integrated Circuit Processing Technology, Addison Wesley Publishing Company".
7. Campbell, S. A., "The Science and Engineering of Microelectronic Fabrication", Oxford University Press.
8. Madou, M. J., "Fundamentals of Microfabrication", CRC Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1	07	08
2	12	13
3	07	08
4	12	13
5	07	08
Total	45	50

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days. Extension lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this camp.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussion Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene

6.1 VLSI SYSTEM DESIGN

L	P
2	4

RATIONALE

Now-a-days thousands of Digital ICs are embedded on one single chip with the help of VLSI technology. This technology helps in reducing the power consumption and silicon area along with enhanced speed. The size of the overall circuit reduced due to embedding of thousands of Digital IC on one VLSI chip. Student should have basic knowledge about this technology because it is used in almost all electron devices.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Design different gates (AND, OR, XOR) using VHDL.
- Develop 2:1 multiplexer, priority encoder, and decoder circuit using VHDL.
- Simulate different arithmetic circuits like half adder, full adder, half subtractor, full subtractor using VHDL.
- Verify 4 Bit Binary to Grey code Converter using VHDL.
- Demonstrate working of different programmable logic devices (ROM, PLA, GAL, PEEL, CPLDs, FPGA, FPAA).

DETAILED CONTENTS

1. Overview of VLSI (05 hrs)

Introduction to Computer-aided design tools for digital systems. Hardware-description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, Logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural, dataflow and structural models.

2. VHDL Statements (05 hrs)

Assignment statements, sequential Statements and process, Conditional statements, Case statements, concept and use of Concurrent statements.

3. Combinational Circuit Design (06 hrs)

VHDL models and simulation of combinational circuits such as Multiplexers, Encoders, Decoders, Code converters, Comparators, Implementation of Boolean functions.

4. Sequential Circuit Design (06 hrs)

VHDL Models and simulation of sequential circuits, Shift registers, Counters etc.

5. Introduction to CPLDs and FPGAs (04 hrs)

Programmable logic devices: ROM, PLAs, GAL, PEEL, CPLDs and FPGA. FPAA (Field Program Analog Array)

6. Design Flow (04 hrs)

The conventional ASIC design flow, Introduction to design methodology challenges (Wire load models, Design verification, floor-planning, placement and routing, power, parasitic extraction.)

LIST OF PRACTIAL EXERCISES

1. VHDL Design of Logic Gates
2. Design of XOR gate using other basic gates
3. Design of 2:1 Mux using other basic gates
4. Design of 2 to 4 Decoder
5. Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
6. Design of Synchronous 8-bit Johnson Counter
7. Design of ALU (Additional, subtraction, Multiplication, Division)
8. CMOS schematic design of logic gates.

- 9 Layout design simulation of logic gates.

RECOMMENDED BOOKS

1. “VLSI Technologies by SZE, Tata McGraw Hill Education Pvt. Ltd, New Delhi.
2. “IEEE Standard VHDL Language Reference Manual”.
3. Roth, Charles. H., “Digital System Design using VHDL”, PWS.
4. Perry, “VHDL-IV Edition”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
5. Geiger, “VLSI Design for Analog”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
6. Weste, and Kamran Eshraghian, “Principles of CMOS VLSI Design”.

RECOMMENDED SOFTWARE

1. Xilinx Synthesis Software (web pack) freely available on internet. On Xilinx.com
2. VLSI System Design is wind software for designing (System Designing).
3. VLSI Learning Resource like Ex-VLSI.

INSTRUCTIONAL STRATEGY

This subject is very important for designing Digital Systems. For this, the students need to have strong base understanding of fundamental concepts of digital electronics. The teacher is required to lay more emphasis on programming practice in VHDL.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (Out of 50)
1	05	07
2	05	07
3	06	11
4	06	11
5	04	07
6	04	07
Total	30	50

6.2 MICROWAVE ENGINEERING

L	P
3	2

RATIONALE

In microwaves industry, job opportunities are available in the area of assembly, production, installation, repair and maintenance of microwave transmitters and receivers. So this subject will help the students to learn about microwaves engineering. It will give exposure to the students about microwave devices and waveguides. It will further help the students to learn about microwave components and communication systems.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Identify, explain and demonstrate construction, characteristics, operating principles and typical applications of Multicavity Klystron, Reflex Klystron, Magnetron, Travelling Wave Tube, GUNN diode, IMPATT diode.
- Measure electronics and mechanical tuning range of a reflex klystron.
- Measure VSWR of a given load.
- Measure the Klystron frequency by slotted section method.
- Measure the directivity and coupling of a directional coupler.
- Demonstrate the properties of magic tee.
- Describe the working principles of microwave communication link.

DETAILED CONTENTS

- | | | |
|----|----------------------------|----------|
| 1. | Introduction to Microwaves | (05 hrs) |
|----|----------------------------|----------|

Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, KU, KA, SUB, mm)

2. Microwave Devices (15 hrs)

Construction, characteristics, operating principles and typical applications of the following devices (No mathematical treatment)

- Multi cavity klystron
- Reflex klystron
- Multi cavity magnetron
- Traveling wave tube
- GUNN DIODE
- Impatt diode

3. Wave Guides (10 hrs)

Rectangular and circular wave guides and their applications. Mode of wave guide; cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation). Impossibility of TEM mode in a wave guide.

4. Microwave Components (10 hrs)

Constructional features, characteristics and application of tees, bends, matched termination, twists, detector, mount, slotted section, directional coupler, fixed and variable attenuator, isolator, circulator and duplex, coaxial to wave guide adapter.

5. Microwave Communication Systems (05 hrs)

Block diagram and working principles of microwave communication link.

LIST OF PRACTICAL EXERCISES

1. To measure electronics tuning range of a reflex klystron
2. To measure mechanical tuning range of a reflex klystron
3. To plot the Voltage Current properties of GUNN diode.
4. To study the frequency sensitivity of attenuator by plotting the output of an attenuator at various frequencies.

5. To determine the frequency and wave length in a Rectangular Waveguide working in TE(1,0) mode.
6. To study the working of microwave circulator.
7. To measure VSWR of a given load.
8. To measure the Klystron frequency by slotted section method
9. To measure the directivity and coupling of a directional coupler.
- 10 To verify the properties of E-plane tee.
11. To verify the properties of H-plane tee.
12. To verify the properties of magic tee.
13. To verify the properties of an isolator.

INSTRUCTIONAL STRATEGY

Microwave and radar engineering is very important subject and requires both theoretical as well as practical exposure. The teaching should be supplemented by visits to the microwave stations and using suitable audio visual aids.

Visit to the appropriate sites of microwave industries, radar installations and communication stations should be made to understand their working. A comprehensive report must be prepared by all the students on these visits, especially indicating the dates and locations of their visits.

RECOMMENDED BOOKS

1. Kennedy, George, & Bernard Davis, "Electronic Communication Systems", McGraw Hill Publishers.
2. Sylio, "Microwave Devices and Components", Prentice Hall of India, New Delhi.
3. Roddy, and Coolen, "Electronics Communication", Pearson Education.
4. Jamwal, KS, " Electronics Communication System", Dhanpat Rai and Sons, Delhi.
- 5 Das, "Microwave Engineering", Tata McGraw Hill Education Pvt Ltd , New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	05	05
2.	15	20
3.	10	10
4.	10	10
5.	05	05
Total	45	50

6.3 WIRELESS AND MOBILE COMMUNICATION

L	P
3	2

RATIONALE

The wireless and mobile communication technology though complex but is spreading at a very fast rate. People use more of mobile phones in comparison to land line phones. This technology is also changing very fast. Therefore, the students should know the functioning of wireless and mobile systems along with different equipment's used.

LEARNING OUTCOMES

After completing the course the student will be able to:

- Identify and explain the features, specification and working of cellular mobile.
- Measure and analyse the signal strength at various points from a transmitting antenna/cordless phone.
- Describe and analyse different Multiple Access Techniques for Wireless Communication (FDMA, TDMA, CDMA).
- Define different Mobile Communication Systems (GSM and CDMA).
- Demonstrate call processing on a GSM and CDMA trainer kit.
- Troubleshoot GSM and CDMA mobile phones.

DETAILED CONTENTS

- | | | |
|-----|--------------------------------------|----------|
| 1. | Wireless Communication | (08 hrs) |
| 1.1 | Basics | |
| 1.2 | Advantages of wireless communication | |
| 1.3 | Electromagnetic waves | |
| 1.4 | Frequency Spectrum used | |
| 1.5 | Cellular network systems | |
| 1.6 | Propagation considerations | |

- a) Range
- b) Atmospheric Effect
- c) Geographic Effect
- d) Fading
- e) Doppler Effect
- f) Multipath Effect

2. Cellular Concept (10 hrs)

- 2.1 Cell area
- 2.2 Cell Site Structure
- 2.3 Capacity of cell
- 2.4 Frequency Response (ARFCN Concepts)
- 2.5 Interference (Co-channel, Adjacent channel)
- 2.6 Power Control for reducing Interference
- 2.7 Fundamentals of cellular network planning
 - a) Coverage planning
 - b) Capacity planning

3. Multiple Access Techniques for Wireless Communication (12 hrs)

- 3.1 Introduction to Multiple Access.
- 3.2 Frequency Division Multiple Access (FDMA)
- 3.3 Time Division Multiple Access (TDMA)
- 3.4 Code Division Multiple Access (CDMA), WCDMA
- 3.5 Spread Spectrum Techniques.

4. Mobile Communication Systems (10 hrs)

- 4.1 Introduction of Global Systems for Mobile Communication (GSM) and its architecture, Introduction of CDMA System, comparison of CDMA and GSM Systems
- 4.2 Introduction of GPRS and EDGE.

5. Introduction 4G and 5G communication systems (5 hrs)
- 5.1 Features of 4G mobile system
 - 5.2 Introduction to types of 4G systems: Long Term Evolution (LTE), Worldwide Interoperability for Wi-Fi
 - 5.3 Advantages and disadvantages of 4G
 - 5.4 Features of 5G mobile system
 - 5.5 5G NR (New Radio) introduction
 - 5.6 Advantages and disadvantages of 5G
 - 5.7 Comparison of 4G with 5G

LIST OF PRACTICAL EXERCISES

1. Study the features, specification and working of cellular mobile
2. Measurement of signal strength at various points from a transmitting antenna/cordless phone
3. Observing call processing of GSM using trainer Kit.
4. Practice of setting GPRS on Mobile phone
5. Troubleshooting GSM Mobile phone
Study parts of Mobile Phone
Testing of various parts
6. Observing working and call processing of CDMA using trainer kit
7. Study and demonstration of AT Commands GSM System using trainer kit
8. Study of LTE mobile communication using trainer kit
9. Study and demonstration of AT Commands of LTE using trainer kit
10. Demonstration of Base Trans Receiver (BTS) with nearby cellular tower

INSTRUCTIONAL STRATEGY

Wireless and Mobile Communication is heaving significant impact in Electronics Market. For the proper awareness of this subject, it is must to provide the students the detailed functioning of wireless/mobile system/equipment. For this, visits must be arranged to BTS/MSC (Mobile Switching Centre) providers. The theory classes need to be application based in addition to industrial visits in the BSNL, Vodafone, Airtel, SPICE, TATA indicom etc.

Students will be motivated in making project which include technologies as discussed above e.g. the status of industrial motor/ sensor is pushed to cloud database and frond end displays the data from cloud database to application available in internet browser. Furthermore the status/ parameters of motor may be altered by user from the front end.

RECOMMENDED BOOKS

1. S.Rappaport, Theodore, “Wireless Communications, Principles and Practice”, Pearson Education.
2. Singal, T. L., “Wireless Communications”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Misra, “Wireless Communications and Networks”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. Agarwal, Dharma Prakash, “Introduction to Wireless and Mobile Systems”, Qing-An zeng, Cengage Learning.
5. Stallings, William, “Wireless Communications and Networks”, Pearson Education.
6. Pandya, Raj, “Mobile and Personal Communication Systems and Services”, Prentice Hall of India, New Delhi.
7. Schiller, John, “Mobile Communication”, Prentice Hall of India, New Delhi.
8. Velrajan, Saro, “An Introduction to 5G Wireless Networks”, Notion Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	08	08
2.	10	11
3.	12	14
4.	10	11
5.	05	06
Total	45	50

6.4 BASICS OF MANAGEMENT

L	P
3	-

RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Marketing management, Financial management, Customer Relationship Management, TQM and Cyber Security etc. have been included in the subject to provide elementary knowledge about these management areas.

LEARNING OUTCOMES

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

- Explain the principles of management including its functions in an organization.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources.
- Maintain and be a part of healthy work culture in an organization.
- Use marketing skills for the benefit of organization.
- Explain basics of accounting and finance.
- Explain the functions of material management.
- Use modern concepts of management.
- Understand various types of cyber crimes and cyber attacks.

DETAILED CONTENTS

- | | | |
|------|--|----------|
| 1. | Principles of Management | (06 hrs) |
| 1.1. | Introduction, importance and general functions of management. | |
| 1.2. | Concept and Types of an organization - Sole trading, partnership, companies, corporation, PSU's and cooperative societies. | |

- 1.3. Structure of an organization: Line organization, Staff organization, Functional organization, Line and staff organization.
- 1.4. Hierarchical Management Structure - Top, middle and lower level management
- 1.5. Departmentalization - Introduction and its advantages.

2. Leadership and Motivation (06 hrs)
 - 2.1 Leadership - Definition and Need of Leadership, Qualities of a good leader, Manager vs. leader, Theories of leadership - trait theory and Behaviour theory.
 - 2.2 Motivation - Definition and characteristics of motivation, Factors affecting motivation, Maslow's Need Hierarchy Theory of Motivation and X&Y need Hierarchy theory of motivation.

3. Work Culture (06 hrs)
 - 3.1. Introduction and importance of healthy work culture in organization
 - 3.2. Components of culture
 - 3.3. Importance of attitude, values and behaviour
Behavioural Science – Individual and group behavior.
 - 3.4. Professional ethics – Concept and need of professional ethics and human values.

4. Human Resource Management and its Functions (04 hrs)

Manpower Planning, recruitment and selection, Training and development of work force at the shop-floor, Performance appraisal, wages, salary and incentive schemes

5. Marketing and sales (06 hrs)
 - 5.1 Marketing - Introduction, importance and its functions, Marketing mix for industries and service sector, Basic Marketing strategies
 - 5.2 Sales - Difference between marketing and selling, Advertisement- print media and electronic media, Market Survey and Sales promotion.

6. Basic of Accounting and Finance (06 hrs)
- 6.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company
- 6.2 Objectives of Financial Management - Profit Maximization v/s Wealth Maximization
7. Material and Stores Management (04 hrs)
- Introduction, functions and objectives of material management, Purchasing - definition and procedure, Just in time (JIT)
8. TQM and TPM (02 hrs)
- Total Quality Management (TQM) and Total Preventive Maintenance (TPM) - Concepts and importance
9. Customer Relationship Management (01 hrs)
- Customer Relationship management - Concept and importance
10. Cyber Security (04 hrs)
- Introduction to Cyberspace and Cyber Law, Pros and Cons of social media, Different Components of cyber Laws; Cyber Law and Netizens, Categories of Cyber Crime: Personal, Business, Financial, Office Security, Cyber Crime – Complete transparency, hacking/cracking, denial of service, IP piracy, phishing, hetaerism etc. Cyber Attack, cyber attackers. Introduction to IPR, copyright & patent

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or

seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. M. Mahajan, "Industrial Management", Dhanpat Rai & Co.
2. S. C. Sharma and T. R. Banga, "Industrial Engineering and Management", Khanna Book Publishing Co. (P) Ltd., New Delhi
3. Narinder Pal Singh, "Basics of Management", Eagle Prakashan, Jalandhar
4. Goel, SL, "Modern Management Techniques", Deep and Deep Publications Pvt. Limited, New Delhi.
5. Nina Godbole and Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	06	06
2.	06	06
3.	06	06
4.	04	05
5.	06	06
6.	06	06
7.	04	05
8.	02	02
9.	01	02
10.	04	06
Total	45	50

6.5 INDUSTRY 4.0 (PART II)

L	P
2	-

RATIONALE

This subject will help the students in understanding advanced concepts related to industry 4.0. This subject will give exposure to the students about Artificial Internet of Things, Machine Learning, Cloud Computing and Industrial internet of Things. It will further help the students to learn about evolution of Industry 5.0.

LEARNING OUTCOMES

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

- Describe the components of AIoT.
- Explain the concept of machine learning.
- Describe the components of block chain.
- Apply 5 G in solving IoT and industrial IoT problems.
- Understand the role and scope of Industry 5.0 for future applications.

DETAIL CONTENTS

1. Technologies in Next Generation Industry 4.0 Environment (4 hrs)

2. Artificial Intelligence of Things (AIoT) (12 hrs)

Internet of Things (IoT) – architecture, protocols, connecting things and pushing data on Internet.

Machine Learning – supervised vs unsupervised learning, Training/Test Dataset, selecting Machine Learning algorithm, accuracy, prediction

Edge/Cloud Computing

3. Blockchain (8 hrs)

Fundamentals, cryptography and crypto currency, public vs private, consensus, Blockchain explorer, wallets-metamask

4. IoT vs Industrial Iot (IIoT) in 5G perspective (3 hrs)
5. Evolution of Industry 5.0 and its role in various Industrial IoT applications, future scope, limitations (3 hrs)

INSTRUCTIONAL STRATEGY

The teachers should lay emphasis on applications of technologies being used in Industry 4.0 environment. Experts may be invited to deliver lectures and share experiences.

RECOMMENDED BOOKS

1. Kuno Pfister, “Getting Started with IoT”, O Reilly Media.
2. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education.
3. Ethem Appaydin, “Introduction to Machine Learning”, PHI Learning.
4. F. Provost and T. Fawcett, “Data Science for Business”, O'Reilly Media.
5. Kumar Sourav and Ashutosh Saxena, “Block Chain Technology”, Wiley Publishers.
6. Schmalstieg and Hollerer, “Augmented Reality: Principles & Practice”, Pearson Education India, ISBN-10: 9332578494
7. Steven M. LaValle, “Virtual Reality”, Cambridge University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	12	20
3	8	14
4	3	05
5	3	05
Total	30	50

6.5 MAJOR PROJECT

L	P
-	10

RATIONALE

Major Project 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 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.
- 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 abilities like interpersonal skills, communication skills, positive attitude and values etc.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strength of students. For this purpose, students should be asked to identify the type of project work, 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 them as major project. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. There should not be more than 6 students in a group. The project work identified in collaboration with industry should be preferred.

This project work should not be considered as merely conventional industrial/field training in which students are sent to work places with either minimal or no supervision. The project work 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 relevant industry/field organizations for providing such an experience to students. It is necessary that each organization is visited well in advance to identify the project. The chosen project needs to match with the curricular interest of students and should be of professional value to industrial/ field organizations.

Some of the project activities are given below:

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

Some of the projects based on above areas are listed below for the benefit of students:

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microcontrollers
4. Temperature monitoring using Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of PCB circuits using Circuit Maker/ EAGLE Software.
8. Fabrication of ON line/OFF line UPS of different ratings and inverters
9. Design, fabrication and testing of different types of experimental boards
10. Repair of oscilloscope, function generator

11. Design and developing web sites of organizations
12. Installation of computer network (LANS).
13. Microcontroller based solar tracking system
14. PLC and SCADA Projects
15. GSM based car or home security system
16. Bank token display using microcontroller
17. Printer sharing unit
18. Microprocessor/Microcontroller Based A/D converter
19. Microprocessor/Microcontroller Based D/A converter
20. Simulation of half wave and full wave rectifiers using Simulation Software
21. Simulation of class A, Class B, Class AB and Class C amplifiers
22. Simulation of different wave forms like sine, square, triangular waves etc.
23. GPS based vehicle tracking system
24. Calculate BER(Bit Error Rate) of various modulation techniques
25. Design ALU using CPLD/FPGA
26. Design Display System using CPLD/FPGA
27. Electronic Weighing Machines
28. VLSI Design Projects

NOTE:

The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.

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 an external and an internal (teacher) examiner is given in the table below:

Sr. No .	Performance Criteria	Max. Marks	Rating Scale						
			Outstanding	Excellent	Very Good	Good	Above Average	Average	Pass
1.	Planning	10	10	9	8	7	6	5	4
2.	Execution	30	30	27	24	21	18	15	12
3.	Quality of Project	20	20	18	16	14	12	10	8
4.	Report Writing	20	20	18	16	14	12	10	8
5.	Presentation/ Viva voce	20	20	18	16	14	12	10	8
Total marks		100	100	90	80	70	60	50	40

Important Note

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner may be a person from industry/organization, who has been associated with the project-oriented professional training of the students or a senior faculty from technical institute.
4. It is proposed that the institute may organize an annual exhibition of the project work.

9. RESOURCE REQUIREMENTS

9.1 Physical Resources

9.1.1 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.

9.1.2 Equipment requirement:

Following Laboratories are required for Diploma Programme in Electronics and Communication Engineering:

1. Computer Lab/Networking Lab
2. Electrical Engineering Laboratory
3. Microwave Engineering Laboratory
4. Audio Video Systems
5. Communication System Laboratory - I
6. Communication System Laboratory – II (Advanced)
7. Industrial Electronics Laboratory
8. VLSI system Design Lab
9. Microcontroller Lab
10. Basic Electronics Lab
11. Digital Electronics and Digital Circuits Laboratory
12. Analog Integrated Circuits
13. PLC and SCADA Lab
14. Electronics and Instrumentation Laboratory

Note: Some of the laboratories can be clubbed keeping in mind best utilization of space and equipment as follows:

EQUIPMENT REQUIRED FOR ELECTRONICS AND COMMUNICATION ENGINEERING

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs) Per Unit
BASIC ELECTRONICS LABORATORY			
1.	DC regulated low voltage variable power supply	10	50,000
2.	DC regulated multiple output power supply	4	20,000
3.	Audio oscillator	4	16,000
4.	Wide band RC Oscillator	4	10,000
5.	RF Signal Generator	2	8,000
6.	Pulse Generator	2	10,000
7.	Function Generator	4	20,000
8.	Digital Storage Oscillos.	5	2,00,000
9.	Electronic Multimeter DC and AC with different ranges	10	30,000
10.	Electronics digital Multimeter three and a half digit	10	30,000
11.	Digital LCR- Q meter	2	20,000
12.	Transistor tester type 911	1	5,000
13.	Audio output power meter	2	6,000
14.	AC Millivoltmeters	4	16,000
15.	DC Millivoltmeters	2	6,000
16.	DC Voltmeter	5	3,000
17.	DC Ammeter	5	3,000
18.	Single Phase VARIAC	3	6,000
19.	Rheostat of different wattage and resistance	5	3,000
20.	Servo stabilizer power supply	1	8,000
21.	IC Bread Boards	20	10,000
22.	Distortion factor meter	1	10,000
23.	Decade resistance, capacitance and inductance (four each)	12	12,000
24.	Strip chart recorder	1	10,000
25.	Digital Panel meters	6	3,000
26.	Digital thermometer	1	4,000
27.	Digital Lux meter	1	8,000
28.	CROs 20 MHz (Scientific Make)	6 Nos.	22,000
29.	Function Generators Audio Frequency	6 Nos.	7,500
30.	Rectifier Kits	6 Nos.	2,200
31.	Filter Circuit Kit	6 Nos.	2,200
32.	Bread Boards	12 Nos.	2,800
33.	Transistor Kits		
	(a) CB	6 Nos.	2,400
	(b) CE	6 Nos.	2,400
34.	FETs	6 Nos.	2,400
35.	Operational Amplifier Kits	6 Nos.	3,000
36.	Raw Materials	LS	20,000

37.	Trainer Board to Study Characteristics of RC Coupled Amplifier	6 Nos	30,000
38.	Trainer Board to Study Characteristics of Transformer Coupled Amplifier	6 Nos	30,000
39.	Trainer Board to Study Characteristics of Direct Coupled Amplifier	6 Nos	30,000
40.	Trainer Board to Study Characteristics of Push Pull Amplifier	6 Nos	30,000
41.	Trainer Board to Study Characteristics of Class A Power Amplifier	6 Nos	30,000
42.	Trainer Board to Study the effect of Negative Feedback	6 Nos	30,000
43.	Trainer Kit of Hartley Colpitts Oscillator	6 Nos	30,000
44.	Trainer Kit of Phase Shift Oscillator	6 Nos	30,000
45.	Trainer Kit of Wein Bridge Oscillator	6 Nos	30,000
46.	Trainer Kit to study Multivibrator Circuits using 555 timer	6 Nos	30,000
47.	Trainer Kit of Arithmetic Circuits using 741 OP AMP	6 Nos	30,000
COMMUNICATION ENGINEERING LABORATORY (BASIC)			
1.	DC regulated low voltage variable Power Supply	6	12,000
2.	*RF Signal Generator	3	15,000
3.	Electronic Multimeter with different voltage ranges	6	22,000
4.	Electronic Digital Multimeter	6	20,000
5.	Standard Signal Generator	2	50,000
7.	Radio Receiver Trainer Kits/Deconstruction Models	LS	10,000
8.	AM/FM signal generator	2	20,000
9.	Super heterodyne Receiver radio Demonstration model	1	4,000
10.	Communication receiver	1	5,000
11.	Optical fibre bench Digital and Analog Link	1 each	50,000
12.	CRO 25 MHz	3	80,000
13.	Digital frequency meter	1	10,000
14.	50 MHz CRO	1	50,000
15.	Modems, opto coupler different types of microphones and other accessories	LS	10,000
16.	Advanced Communication Trainer	LS	1,00,000
17.	EPFAX, 56 lines including	LS	60,000
18.	Cellular Mobile Kit	2 each	10,000
19.	Pulse Modulation and Demodulation	6	20,000
20.	Pulse Amplitude Modulation and Demodulation	6	18,000
21.	Pulse Width Modulation and Demodulation	6	18,000
22.	Data Formatting and Carrier Modulation Transistor Trainer Model (ST 2106)	6	25,000
23.	Carrier Demodulation of Data Reformatting Receiver Trainer Kit (ST 12107)	6	25,000
24.	Trainer Board to Study Characteristics of Armstrong Transmitter	6	30000
25.	Antenna Trainer Kit	LS	100000
26.	Optical Fiber Splice Connector Loss Measurements Kit	1	25000

27.	Optical Fiber Numerical Aperture Measurements Kit	1	10000
28.	Trainer Kit to study Characteristics of Optical Source	6	30000
29.	Trainer Kit to study Characteristics of Optical Detector	6	30000
30.	Trainer Kit to study Amplitude Shift Keying	6	30000
31.	Trainer Kit to study Phase Shift Keying	6	30000
32.	Trainer Kit to study Frequency Shift Keying	6	30000
33.	Trainer Kit to study QPSK	6	30000
34.	Audio Input Module Trainer Model (ST 2108)	6	12,000
35.	Audio Output Model Trainer Model (ST 2109)	6	8,000
36.	AM Transmitter Trainer Model (ST 2201) Scientech	6	20,000
37.	AM Receiver Trainer Model (ST 2202) Scientech	6	20,000
38.	FM Communication Trainer Model (ST 2203) Scientech	6	25,000
39.	Sampling Reconstruction Trainer (ST 2101)	6	11,000
40.	Pulse Code Modulation Transmitter (ST 2103)	6	25,000
41.	Pulse Code Modulation Receiver (ST 2104)	6	25,000
42.	Delta Adaptive Delta Sigma Modulation and Demodulation Trainer (ST 2105)	6	30,000
COMMUNICATION SYSTEM LABORATORY – II (Advanced)			
1.	Kit - IF Amplifier Transistor	6 Nos.	1,500
2.	Kit – Amplitude Modulation Demodulation (DSB)	6 Nos.	2,500
3.	Kit – Double Balanced Modulator/Demodulator	6 Nos.	4,500
4.	Kit – Frequency Modulator Demodulator (Transistorized)	6 Nos.	2,200
5.	Kit – Computer and locking range of PLL	6 Nos.	1,600
6.	Kit – Frequency Demodulation (IC Based)	6 Nos.	1,600
7.	Kit – Sample and Hold (S/H) function for Digital Study	6 Nos.	2,600
8.	IF Amplifier (IC Based)	6 Nos.	1,600
9.	Frequency Synthesizer	6 Nos.	1,600
10.	Microwave Trainer Kit with Reflex Klystron	LS	100000
TELEVISION / AUDIO-VIDEO LABORATORY			
1.	DC regulated low voltage variable power supply	3	10,500
2.	DC regulated low voltage variable power supply	1	6,000
3.	Audio signal generator	4	16,000
4.	RF Oscillator	4	20,000
5.	Electronic multimeter Analog	6	22,000
6.	Electronic digital multimeter	4	12,000
7.	AF output power meter	2	6,000
8.	Signal tracer	2	3,000
9.	Signal Injector	2	500
10.	VCR Trainer	1	40,000
11.	UHF/VHF Convertor	3	3,500
12.	CCTV System PAL Based	1 set	40,000
13.	Field Strength meter	1	5,000
14.	Satellite Receiver, Mixer Amplifier	LS	10,000
15.	TV receiving antenna-Yagi,Uda turnstile and log periodic	2	1,000
16.	Dish Antenna with LNB	1	10,000
17.	Stereo cassette deck with speakers	1	6,000

18.	Public Address System	LS	50000
19	Projection Display System	LS	25000
20.	LED TV Trainer Kit	1	50000
21.	LCD TV Trainer Kit	1	50000
22.	DTH set up kit	LS	25000
23.	RF power meter	1	7,000
24	Cassette tape recorder Trainer	1	10,000
25.	Compact Disc player system	1	10,000
26.	PA system with microphone	2	5,000
27.	Mixing pre-amplifier	2	5,000
28.	Microphone	4	6,000
29.	Loud Speaker	2	2,000
30.	Cassette Duplicator	1	2,000
31.	Audio Test System	1	12,000
32.	Digital Frequency Counter	1	5,000
33.	Video Cassette Player	1	15,000
34.	CRO Dual Trace	3	90,000
35.	RF Sweep Generator for TV Alignment	2	25,000
36.	Pattern generator	2	5,000
37.	Video Projector System	1	2,00,000
38.	TV Trainer Kit (B/W)	6 Nos.	13,000
39.	TV Trainer Kit (Colour)	6 Nos.	33,000
40.	Digital Storage Oscilloscope (Scientific or Hamag)	10 Nos.	34,000
41.	Wobbuloscope (B/W – 250 MHz)	4 Nos.	50,000
42.	Pattern Generators B/W	6 Nos.	3,200
43.	Pattern Generators Colour	6 Nos.	8,000
ELECTRONICS WORKSHOP			
1.	Hand Tools Set	5	5,000
2.	Soldering Set`	5,	5,000
3.	Hand Drill	1	3,000
4.	PCB Etching Machine	2	2,500
5.	Silk Screen Printing	2 set	50,000
6.	Drafting Equipment	1 set	15,000
7.	PCB Drilling Machine	1	10,000
8.	Sheet metal folding and binding machine	1	20,000
9.	Sheet metal cutting machine	1	5,000
10.	Centre Lathe	1	15,000
11.	Grinder	1	6,000
12.	Circular saw	1	6,000
13.	*DC regulated low voltage variable power supply	2	12,000
14.	*Audio Oscillator	2	6,000
15.	*RF Signal generator	2	8,000
16.	*Digital LCR-Q meter	1	10,000
17.	*Digital multi-meter	4	12,000
18.	*Single trace CRO	2	25,000
19.	*AC Milivoltmeter	1	3,500

20.	IC Bread boards	6	3,000
21.	Soldering stations temperature controlled	7	10,500
22.	Solder suckers with accessories	10	500
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)	2	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Arduino Kits	5	30,000
12.	Computer Trainer	1	30,000
13.	Interfacing Cards with 8051	LS	2,50,000
	-Sensors cards		
	-Wifi cards		
	-bluetooth cards		
	-DC motor interface with motor		
	-LCD interface		
14.	Micro-controller Kit 8051 based	10	1,00,000
15.	Digital IC Tester Model - Nikki	1 No.	50,000
16.	Universal Programmer	1 No.	7,000
17.	Digital Multimeter (Motwane)	10 No.	60,000
18.	EPROM Programme	1	10,000
19.	EPROM Eraser	1	1,500
20.	Additional cards	LS	50,000
21.	Trainer Board to Study flip flops	5	30000
22.	Trainer Board to Study encoder/ decoder	5	30000
23.	Trainer Board to Study multiplexer/ demultiplexer	5	30000
24.	Trainer Board to Study Shift Registers SIPO, SISO	5	30000
25.	Trainer Board to Study Shift Registers PISO, PIPO	5	30000
26.	Trainer Board to Study Ring Counters	5	30000
INSTRUMENTATION AND MEASUREMENT LABORATORY			
1.	Light Measurement (Photocells) Kit	8 Nos.	15,000
2.	LVDT Kit	8 Nos.	8,000
3.	Pressure Measurement Kit	8 Nos.	9,500
	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and potentiometer etc	LS	30,000
4.	Strain Measurement Kit	8 Nos.	14,000
5.	Water Level Measurement Kit	8 Nos.	11,500
6.	Velocity Measurement Kit	8 Nos.	7,500
7.	RPM Measurement Kit	8 Nos.	5,000

8.	Temperature Measurement Kit	8 Nos.	5,000
9.	Maxwell's Bridge Kit	8 Nos.	7,500
10.	Wein's Bridge Kit	8 Nos.	4,500
11.	Anderson Bridge Kit	8 Nos.	5,000
12.	Flux Meter (Digital) Kit	8 Nos.	5,000
13.	Q. Meter (Digital) Kit	8 Nos.	5,000
ELECTRICAL ENGINEERING LABORATORY			
1.	Ammeter, Voltmeter, Wattmeter and Energy Meters (3- phase and 1- phase)	8 each	40,000
2.	3-Phase Resistive load	4 Nos.	16,000
3.	LCR/Q Bridge	1	5,000
4.	Tong tester	4	12,000
5.	Transformer (single phase)	2	16,000
6.	Watt meter, Volt meter, Ammeter,	2 each	10,000
7.	DC Shunt Motor, 2 hp with loading arrangement	1	20,000
8.	Induction Motor (Single phase)	2	10,000
9.	Induction Motor (Three phase)	2	10,000
10.	Slipping Induction Motor 3 HP with loading facility	1	25,000
11.	Alternator and Load for Alternators	1	25,000
12.	DC generator with prime-mover motor	2	25,000
13.	DC Regulated Power Supply	2	6,000
14.	Starters (DOL and Star Delta)	2 each	8,000
15.	Rheostats	4	12,000
16.	Tacho meters (digital)	2	15,000
17.	Maggar (Insulation Tester)	2	5,000
18.	Earth Tester	2	10,000
19.	Digital Multi-meter	10	32,000
20.	Rectifier, Inverter Set	1	10,000
21.	Servomotor with starter	1	20000
22.	Stepper Motor with starter	1	20000
23.	Synchronous Motor with starter	1	20000
INDUSTRIAL ELECTRONICS LABORATORY (For Electrical, Electronics and Computer Engineering)			
1.	Morgan Chopper Kit	6 Nos.	5,000
2.	Joner Chopper	6 Nos.	5,000
3.	Series Inverter	6 Nos.	8,000
4.	Parallel Inverter	6 Nos.	8,000
5.	Speed Control of dc motor (Thyristorized)	6 Nos.	5,000
6.	Single Phase Cyclo Convertor with Thyristors	6 Nos.	20,000
7.	Kit for study of effect of free wheeling diode on power factor	6 Nos.	5,000
8.	SCR Characteristics	6 Nos.	1,500

9.	Gate Triggering Characteristics of SCR	6 Nos.	10,000
10.	AC Phase Control Trainer Kit using	6 Nos.	6,000
11.	Kit to Study 3-phase Control Bridge Convertor	6 Nos.	17,500
12.	UJT Characteristics and its Application as Relaxation Oscillator	6 Nos.	1,500
13.	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit	LS	2,50,000
14.	Trainer Kit to study characteristics of DIAC	6 Nos.	30000
15.	Trainer Kit to study characteristics of TRIAC	6 Nos.	30000
16.	Trainer Board to Study Half Wave Controlled Rectifier	6 Nos.	30000
17.	Trainer Board to Study Full Wave Controlled Rectifier	6 Nos.	30000
18.	Trainer Board for SCR based Lamp intensity control	6 Nos.	30000
19.	Trainer Board for SCR fan speed control	6 Nos	30000
PLC SCADA LABORATORY			
1	PLC Trainer Kits	LS	200000
2.	PLC Simulator Software	LS	100000
3.	PLC interface cards	LS	100000
COMPUTER LAB			
1.	Desktop Computers	20	1500000
2	Printers	3	50000
3	Networking wifi/ LAN	LS	50000

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

9.1.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

9.2 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.

10. LIST OF CONTRIBUTORS/EXPERTS

- a) Online Curriculum Workshops for Designing the Contents of First Year Subjects for Diploma Programmes for Punjab State on 22nd April, 2022, 26th April, 2022, 28th April, 2022, 12th May, 2022 13th May, 2022, 16th May, 2022, 17th May, 2022, 24th May, 2022 and 6th June, 2022 at NITTTR, Chandigarh

S. No.	Name, Designation and Official Address
1.	Ms. Kanwaldeep Kaur, HOD, Applied Mathematics, SGHS Govt Polytechnic College, Ranwan
2.	Ms. Ravneet Kaur, HOD, Architecture Assistantship, Govt Polytechnic College for Girls, Patiala
3.	Mr. Harsh Kumar, HOD, Chemical Engg., Govt Polytechnic College GTB Garh
4.	Ms. Raman Rani Mittal, Senior Lecturer, Chemistry, Govt Polytechnic College for Girls, Patiala
5.	Ms. Monica Sethi, Senior Fashion Designer, Fashion Design, Govt. Institute of Garment Technology, Amritsar
6.	Ms. Jaspreet Kaur, HOD, Garment Manufacturing Technology, SRS Govt Polytechnic College for Girls, Ludhiana
7.	Ms. Gurleen Kaur, Principal, Interior Design & Decoration, Govt Polytechnic for Women, Chandigarh
8.	Mr. Rohit Dalia, Lecturer, Leather Technology & Leather Technology(Footwear), Govt. Institute of Leather and Footwear Technology, Jalandhar
9.	Ms. Mandeep Kaur, Senior Lecturer, Library & Information Science, Govt Polytechnic College for Girls, Jalandhar
10.	Ms. Jagminder Kaur Mann, HOD, Medical Lab. Technology, Govt Polytechnic College for Girls, Patiala
11.	Ms. Parveen Kaur, HOD, Modern Office Practice, Govt Polytechnic College, Khuni Majra
12.	Mr. Kulwinder Singh Bedi, HOD, Physics, Govt Polytechnic College, Behram

13.	Mr. Parveen Kumar Randev, Lecturer Textile Chemistry, Textile Processing & Textile Technology (Knitting), Govt. Institute of Textile Chemistry & Knitting Technology, Ludhiana
14.	Mr. Amrik Singh Rakhra, HOD, Textile Technology/Textile Design, Punjab Institute of Textile Technology, Amritsar
15.	Mr. Kuldip Rai, Workshop Superintendent, Govt Polytechnic College, Khuni Majra
16.	Mr. Harkesh Kumar, Workshop Instructor, Govt Polytechnic College, Khuni Majra
17.	Mr. Prabhpreet Singh, HOD, Automobile Engineering, Guru Nanak Dev Polytechnic College, Ludhiana
18.	Mr. Rajinder Kumar, Senior Lecturer, Civil Engg., Govt Polytechnic College, Amritsar
19.	Mr. Vipin Arora, HOD, Computer Science Engineering, Govt Polytechnic College for Girls, Jalandhar
20.	Mr. Madan Lal Rana, HOD, Electrical Engineering, Chandigarh College of Engineering and Technology (Diploma Wing), Chandigarh
21.	Mr. Sanjeev Goyal, HOD, Electronics & Communication Engineering, SGHS Govt Polytechnic College Ranwan
22.	Ms. Jasdeep Kaur, HOD, English & Communication Skills, Govt Polytechnic College, Khuni Majra
23.	Mr. Lakhbir Singh, Senior Lecturer, Information Technology, SRS Govt Polytechnic College for Girls, Ludhiana
24.	Mr. Jasvinder Singh, HOD, Mechanical Engineering, Govt Polytechnic College, Bathinda
25.	Mr. Kashhmiri Lal, HOD, Production and Industrial Engg., Govt Polytechnic College, Amritsar
26.	Dr G H Hugar, Cecturer Chandigarh College of Engineering and Technology Diploma Wing, Deptt of Applied Science Chandigarh
27.	Mr. Amarjit Singh, Sr Lect, Govt Polytechnic College Bathinda
28.	Mr. Jasbir Singh Waraich, Sr Lect, SRS Govt Polytechnic College for Girls Ludhiana

29.	Ms. Shelly Singla, Lect, Govt Polytechnic College Khuni Majra
30.	Ms. Narinder Kaur, Lect, Chandigarh College of Engineering and Technology (Diploma Wing), Chandigarh
31.	Dr Bhupinder Singh, HOD, Govt Polytechnic College, Chheherta, Amritsar
32.	Mr. S A Khan, HOD, SRS Govt Polytechnic College for Girls, Ludhiana
33.	Mr. Ritwinder Singh, Workshop Instructor, Govt Polytechnic, Badbar
34.	Mr. Jasvir Singh, Foreman Instructor, S R S Govt Polytechnic College For Girls Ludhiana
35.	Mr. Gurjit Singh, Foreman Instructor, Govt Polytechnic College Bathinda
36.	Mr. H S Kalra, Ex-Principal, ITI, Sector 28, Chandigarh
37.	Mr. Balwan Singh, Officer Incharge- Mechanical Workshop, ABIT
38.	Mr. SS Ubhi, Ex Workshop Supdtt., Guru Nanak Dev Polytechnic College, Ludhiana
39.	Mr. Harinderjit Singh, Lecturer, Thapar Polytechnic Patiala
40.	Mr. Manmohan Krishan, Senior Lecturer, Govt Polytechnic College Kotkapura
41.	Ms. Manninder Kaur, Lecturer, Govt Polytechnic College For Girls Ropar
42.	Mr. Gagandeep Singh, Lecturer, Govt Polytechnic College Bathinda
43.	Mr. Pankaj Chawla, Lecturer, Env Studies, Pt JR Govt Polytechnic Hoshiarpur
44.	Mr. Rajesh Kumar, Lecturer Env. Studies, Mehr Chand Poly Jalandhar
45.	Ms. Shavinder Kaur, Lecturer (Chemistry), Thapar Polytechnic Patiala
46.	Mr. Ajay Kumar, Lecturer, Chemistry, Pt JR Govt Polytechnic Hoshiarpur
47.	Ms. Rekha Gupta, Sr Lecturer., SRS Govt Polytechnic College For Girls Ludhiana
48.	Mr. Rakesh Mittal, Sr Lecturer, Govt Polytechnic College Kotkapura
49.	Mr. Yogesh Kumar, Lecturer, Govt Polytechnic College For Girls Patiala
50.	Ms. Anchal Jain, Lect., SGHS Govt Polytechnic College Ranwan

51.	Ms. Suman Sharma, Lecturer, Govt Polytechnic College Khunimajra Mohali
52.	Mr. Kuldeep Kumar, Lecturer, Pt JR Govt Polytechnic Hoshiarpur
53.	Ms. Jyoti Ghai, Lecturer, Thapar Polytechnic, Patiala
54.	Ms. Jasmeet Kaur, Sr Lect, Govt Polytechnic College Amritsar
55.	Ms. Sandeep Kaur, Lect, SRS Govt Polytechnic College For Girls Ludhiana
56.	Ms. Amandeep Kaur, Lect, Govt Polytechnic College Khuni Majra
57.	Ms. Shubhashree Chakraborty, Lecturer (English), Thapar Polytechnic, Patiala
58.	Ms. Meenu Dutta, Lecturer, Pt JR Govt Polytechnic, Hoshiarpur
59.	Ms. Sharanjit Kaur, Lecturer, Mehr Chand Polytechnic
60.	Ms. Aman Singla, Lecturer, CSE, Thapar Polytechnic, Patiala
61.	Ms. Tarandeep Kaur, Lecturer, CSE, Thapar Polytechnic, Patiala
62.	Ms. Divya Jyoti, Lecturer, Pt. J R Govt. Polytechnic, Hoshiarpur
63.	Mr. Manoj Jambla, HOD, CSE, Govt Polytechnic College For Girls, Ludhiana
64.	Dr. Anshu Sharma, Sr Lecturer, Govt Polytechnic College, Khunimajra
65.	Mr. Kulwinder Singh Pannu, HOD, Electronics & Communication Engineering, SGHS GPC, Ranwan
66.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- b) Online Curriculum Workshops for Designing the Contents of Open Electives for Diploma Programmes for Punjab State on 27th March, 2023, and 8th May, 2023, at NITTTR, Chandigarh

S. No.	Name, Designation and Official Address
1.	Ms. Raman Rani Mittal, Sr Lecturer, Chemistry, Govt Polytechnic College For Girls, Patiala
2.	Ms. Monica Sethi, Senior Fashion Designer, Fashion Design, GIGT, Amritsar
3.	Ms. Jaspreet Kaur, HOD, Garment Manufacturing Technology, SRS GPCG Ludhiana
4.	Ms. Gurleen Kaur, Principal, Interior Design & Decoration, GPW, Chandigarh
5.	Ms. Jagminder Kaur Mann, HOD, Medical Lab. Technology, Govt Polytechnic College For Girls, Patiala
6.	Mr. Amrik Singh Rakhra, HOD, Textile Technology/Textile Design, PITT, Amritsar
7.	Mr. Prabhpreet Singh, HOD, Automobile Engineering, GNDP College, Ludhiana
8.	Mr. Madan Lal Rana, HOD, Electrical Engineering, CCET, Chandigarh
9.	Mr. Lakhbir Singh, Senior Lecturer, Information Technology, SRS Govt Polytechnic College For Girls, Ludhiana
10.	Mr. Rajinder Kumar, HOD, Civil Engg., Govt Polytechnic College, Amritsar
11.	Ms. Monica Jaggi, Lecturer, Govt Polytechnic College For Girls, Patiala
12.	Mr. Suresh Gandhi, PITT, Amritsar
13.	Mr. Naresh Kumar, PITT Amritsar
14.	Ms. Ramanpreet Kaur, Lecturer Spinning, Textile Technology, Amritsar
15.	Ms. Ravneet Kaur, HOD, Architecture Assistantship, Govt Polytechnic College For Girls, Patiala
16.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- c) Online Workshops to Develop the Curriculum of Diploma Programme in ‘Electronics and Communication Engineering’ for the State of Punjab on 4th May, 2022, 20th June, 2022, 11th August, 2022, 22nd November, 2022, and 23rd December, 2022 at NITTTR, Chandigarh

S. No.	Name, Designation and Official Address
1.	Mr. Sanjeev Goyal, HOD, SGHS Government Polytechnic College, Ranwan
2.	Mr. Jatinder Pal, HoD, ECE, Government Polytechnic College, Ferozpur
3.	Mr. Manjit Singh, HOD, Government Polytechnic College, Bathinda
4.	Mr. Kulwinder Singh, Sr Lect, SGHS Government Polytechnic College, Ranwan
5.	Mr. Mukul Mittal, Lecturer, Government Polytechnic College for Girls, Patiala
6.	Nishu Kansal, Lecturer, SGHS Government Polytechnic College, Ranwan
7.	Parul Sharma, JRF, Indian Institute of Technology, Jammu
8.	Mr. Sanjay Gupta, Industry, Gigabyte Networks Pvt Ltd
9.	Dr. T. Kishore, Professor, National Institute of Technology, Warangle, ECE
10.	Dr. Vishal Bhanagar, Professor, CSE, NSUIT
11.	Dr. Balwinder Singh, Joint Director, CDAC, Mohali
12.	Dr. Balwinder Raj, Associate Professor, NIT, Jalandhar
13.	Dr. Rajesh Mehra, Professor, Curriculum Development Centre, NITTTR, Chandigarh
	Coordinator