

CURRICULUM

DIPLOMA IN MECHATRONICS



**MSME TECHNOLOGY CENTRE,
ROHTAK**

w.e.f. 2020-21

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1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN MECHATRONICS ENGINEERING

- | | | | |
|----|-----------------------------------|---|--|
| 1) | Name of the Programme | : | Diploma Programme in Mechatronics Engineering |
| 2) | Duration of the Programme | : | Three Years (Six Semesters) |
| 1) | Entry Qualification | : | Matriculation or equivalent qualification prescribed by Haryana State Board of Technical Education |
| 3) | Intake | : | 60 seats (As per AICTE) |
| 4) | Pattern of the Programme | : | Semester Pattern |
| 5) | Ratio between theory and practice | : | 40 : 60 (Approx.) |

6) Industrial Training:

Six weeks of industrial training is included after IV semester during summer vacation. Internal Assessment out of 50 marks and external assessment out of another 50 marks will be added in 5th semester. Total marks allotted to industrial training will be 100.

Distribution of Marks:

- | | | |
|---------------------------------------|---|----------|
| ➤ Daily diary and reports of training | - | 50 Marks |
| ➤ Viva Voce (External) | - | 50 Marks |

7) Ecology and Environment:

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

8) 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.

9) Entrepreneurship Development:

An Entrepreneurial Awareness Camp and a full subject on Generic Skills and Entrepreneurship Development have been incorporated in the curriculum.

10) “Ecology and Environmental Awareness Camps” have been added in Ist Semester under Student Centered Activities.

11) Camps on “Traffic Awareness and Road Safety” have been added in semester V & VI under Student Centered Activities

12) Student Centered Activities:

A provision of 3-6 hrs. Per week has been made for organizing Student Centered 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 and other cultural activities etc.

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

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN MECHATRONICS ENGINEERING

The following are the major employment opportunities for diploma holders in Mechatronics Engineering:

- In manufacturing and electronics industry primarily in private sector and to some extent in public sector.
- In service sector like Railways, Hospitals, Military Engineering Services, Boards and Corporations, Constructions companies, Transportation Departments, Telecommunication, PWD and Rural Development Agencies.
- In marketing sector for sales and after-sales services
- As an entrepreneur
- Though the diploma holders in Mechatronics Engineering find placement in all functional areas like R&D, planning, shop floor production, quality control, maintenance, inventory management but majority of them find employment in shop floor management.

3. ABSTRACT OF THE CURRICULUM AREAS

a) General Studies

1. English and Communication Skills
2. Environmental Studies
3. Employability Skills
4. Entrepreneurship Development and Management

b) Applied Sciences

5. Applied Mathematics
6. Applied Physics

c) Basic Courses in Engineering /Technology

7. Basic of Information Technology
8. Engineering Drawing
9. General Workshop Practice
10. Basic of Electrical Engineering
11. Basic Electronics
12. Mobile and Wireless Communication

a) Applied Courses in Engineering/Technology

13. Non-conventional Manufacturing Process
14. Electric power transmission and distribution
15. Electronic Instrumentation
16. Computer Programming and Application
17. Computer Aided Drafting
18. Digital Electronics
19. DC and AC Machines
20. Embedded System
21. Electrical & Electronic Instrumentation and Measurement
22. Hydraulic and Pneumatic Systems
23. Mechatronics - Design and Drafting
24. CNC Machines and Automation
25. Power Electronics
26. Internet of Things
27. Process Control and Data Communication

- 28. Industrial Automation
- 29. Robotics
- 30. Inspection and Quality Control
- 31. Mechanisms and Machines
- 32. Project Work

d) Industrial Training

- 33. Industrial Training

4. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

S.No.	Subjects	Distribution in Hours per week in various Semester					
		I	II	III	IV	V	VI
1	English and Communication Skills	5	5	-	-	-	-
2	Applied Mathematics	5	5	-	-	-	-
3	Applied Physics	6	6	-	-	-	-
4	Basic of Information Technology	3	-	-	-	-	-
5	Engineering Drawing	6	-	-	-	-	-
6	Environmental Studies	3	-	-	-	-	-
7	General Workshop Practice	9	9	-	-	-	-
8	Basic of Electrical Engineering	-	6	-	-	-	-
9	Basic Electronics	-	6	-	-	-	-
10	Non-conventional Manufacturing Process	-	-	6	-	12	-
11	Mobile and Wireless Communication	-	-	5	-	-	-
12	Electric power transmission and distribution	-	-	8	-	-	-
13	Electronic Instrumentation	-	-	5	-	-	-
14	Computer Programming and Application	-	-	6	-	-	-
15	Computer Aided Drafting	-	-	7	-	-	-
16	Digital Electronics	-	-	-	6	-	-
17	DC and AC Machines	-	-	-	6	-	-
18	Embedded System	-	-	-	7	-	-
19	Electrical & Electronic Instrumentation and Measurement	-	-	-	6	-	-
20	Hydraulic and Pneumatic Systems	-	-	-	7	-	-
21	Mechatronics - Design and Drafting	-	-	-	6	-	-
22	CNC Machines and Automation	-	-	-	-	7	-
23	Power Electronics	-	-	-	-	7	-
24	Employability Skills	-	-	-	-	2	2
25	Internet of Things	-	-	-	-	4	-
26	Process Control and Data Communication	-	-	-	-	3	-
27	Industrial Automation	-	-	-	-	-	6
28	Robotics	-	-	-	-	-	6
29	Inspection and Quality Control	-	-	-	-	-	6
30	Entrepreneurship Development and Management	-	-	-	-	-	3
31	Mechanisms and Machines	-	-	-	-	-	3
32	Project Work	-	-	-	-	-	9
33	Student Centered Activities	3	3	2	2	5	5
Total		40	40	40	40	40	40

5. STUDY AND EVALUATION SCHEME FOR THE DIPLOMA IN MECHATRONIC ENGINEERING First

Semester (Mechatronics)

S. No	SUBJECTS	STUDY SCHEME Hrs/Week		Marks in Evaluation Scheme								
				Internal Assessment			External Assessment					Total Marks of Int. & Ext.
		L	P	Th	Pr	Tot -al	Th	Hrs	Pr	Hrs	Tot -al	
1.1	English and Communication Skills - I	3	2	25	25	50	75	3	25	3	100	150
1.2	Applied Mathematics-I	5	-	25	-	25	75	3	-	-	75	100
1.3	Applied Physics-I	4	2	25	25	50	75	3	25	3	100	150
1.4	Basics of Information Technology	-	3	-	50	50	-	-	50	3	50	100
1.5	Engineering Drawing-I	-	6	-	50	50	-	-	100	4	100	150
1.6	Environment Studies	3	-	25	-	25	75	3	-	-	75	100
1.7	General Workshop Practice-I	-	9	-	100	100	-	-	75	4	75	175
#Student Centered Activities		-	3	-	25	25	-	-	-	-	-	25
Total		15	25	100	275	375	300		275		575	950

Second Semester (Mechatronics)

S. No	SUBJECTS	STUDY SCHEME Hrs./Week		Marks in Evaluation Scheme								
				Internal Assessment			External Assessment					Total Marks of Int. & Ext.
		L	P	Th	Pr	Total	Th	Hrs	Pr	Hrs	Tot -al	
2.1	English and Communication Skills - II	3	2	25	25	50	75	3	25	3	100	150
2.2	Applied Mathematics-II	5	-	25	-	25	75	3	-	-	75	100
2.3	Applied Physics-II	4	2	25	25	50	75	3	25	3	100	150
2.4	Basic Electronics	4	2	25	25	50	75	3	25	3	100	150
2.5	Basic of Electrical Engineering	4	2	25	25	50	75	3	25	3	100	150
2.6	General Workshop Practice-II	-	9	-	100	100	-	-	75	4	75	175
# Student Centered Activities		-	3	-	25	25	-	-	-	-	-	25
Total		20	20	125	225	350	375		175		550	900

Third Semester (Mechatronics)

S. No	SUBJECTS	STUDY SCHEME Hrs/Week		Marks in Evaluation Scheme								
				Internal Assessment			External Assessment					Total Marks of Int. & Ext.
		L	P	Th	Pr	Tot -al	Th	Hrs	Pr	Hrs	Tot -al	
3.1	Non-Conventional Manufacturing Process	4	-	25	-	25	100	3	-	-	100	125
3.2	Mobile and Wireless Communication	3	2	25	25	50	100	3	50	3	150	200
3.3	Electric power transmission and distribution	4	4	25	25	50	100	3	50	3	150	200
3.4	Electronic Instrumentation	3	2	25	25	50	100	3	50	3	150	200
3.5	Computer Programming and Application	2	4	25	25	50	100	3	50	3	150	200
3.6	Computer Aided Drafting	-	7	-	50	50	-	-	75	3	75	125
#Student Centered Activities		-	2	-	25	25	-	-	-	-	-	25
Total		12	28	100	225	325	400		325		725	1050

Fourth Semester (Mechatronics)

S. No	SUBJECTS	STUDY SCHEME Hrs/Week		Marks in Evaluation Scheme								Total Marks of Int. & Ext.
				Internal Assessment			External Assessment					
		L	P	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	Digital Electronics	4	2	25	25	50	75	3	25	3	100	150
4.2	DC and AC Machines	4	2	25	25	50	100	3	50	3	150	200
4.3	Embedded System	4	3	25	25	50	100	3	50	3	150	200
4.4	Electrical & Electronic Instrumentation and Measurement	3	3	25	25	50	100	3	50	3	150	200
4.5	Hydraulic & Pneumatic Systems	4	3	25	25	50	100	3	50	3	150	200
4.6	Mechatronics - Design and Drafting	-	6	-	50	50	-	-	50	3	50	100
#Student Centered Activities		-	2	-	25	25	-	-	-	-	-	25
Total		19	21	125	200	325	475		275		750	1075

Industrial Training- After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 4/6 weeks and shall prepare a diary. It shall be evaluated during 5th semester 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.

Fifth Semester (Mechatronics)

S. No	SUBJECTS	STUDY SCHEME Hrs/Week		Marks in Evaluation Scheme									Total Mark s of Int. & Ext.
				Internal Assessment			External Assessment						
		L	P	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
Industrial Training		-	-	-	50	50	-	-	50	3	50	100	
5.1	CNC Machines and Automation	4	3	25	25	50	75	3	50	3	125	175	
5.2	Power Electronics	4	3	25	25	50	75	3	25	3	100	150	
5.3	Employability Skills-I	-	2	-	25	25	-	-	50	3	50	75	
5.4	Internet of Things	-	4	-	50	50	-	-	100	3	100	150	
5.5	Process Control and Data Communication	3	-	25	-	25	100	3	-	-	100	125	
5.6	Manufacturing Process II	3	9	25	50	75	100	3	75	3	175	250	
#Student Centered Activities		-	5	-	25	25	-	-	-	-	-	25	
Total		14	26	100	250	350	350		350		700	1050	

Sixth Semester (Mechatronics)

S. No	SUBJECTS	Marks in Evaluation Scheme										
		STUDY SCHEME Hrs/Week		Internal Assessment			External Assessment					Total Marks of Int. & Ext.
		L	P	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Industrial Automation	3	3	25	25	50	100	3	50	3	150	200
6.2	Robotics	3	3	25	25	50	100	3	50	3	150	200
6.3	Inspection and Quality Control	4	2	25	25	50	100	3	50	3	150	200
6.4	Entrepreneurship Development and Management	3	-	25	-	25	100	3	-	-	100	125
6.5	Employability Skills II	-	2	-	25	25	-	-	50	3	50	75
6.6	Mechanisms and Machines	3	-	25	-	25	100	3	-	-	100	125
6.7	Project Work	-	9	-	100	100	-	-	100	3	100	200
#Student Centered Activities		-	5	-	25	25	-	-	-	-	-	25
Total		16	24	125	225	350	500		300		800	1150

6. INDUSTRIAL TRAINING OF STUDENTS

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Diploma. 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 of organization. It prepares students for their future role as diploma engineer in the world of work and enables them to integrate theory with practice. Diploma has been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4/6 weeks duration to be organized during the semester break starting after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to the specific branch. It is suggested that a training schedule may be drawn for each students 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 studying and evaluation scheme of the 5th Semester. Evaluation of professional industrial training report through viva-voice/presentation aims at assessing students understanding of materials, industrial process, practice 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% |

7. GUIDELINES FOR ASSESSMENT OF STUDENT CENTERED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- A)
- i. 5 Marks for general behavior and discipline
(By HODs in consultation with all the teachers of the department)
 - ii. 5 Marks for attendance as per following:
(By HODs in consultation with all the teachers of the department)
 - a) 75% Nil
 - b) 75 – 80% 2 Marks
 - c) 80 – 85% 3 Marks
 - d) Above 85% 5 Marks
 - iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following:
(By In-charge Sports/NCC/Cultural/Co-curricular/NSS)
 - a) 15 - National Level participation
 - b) 10 - Participation in two of above activities
 - c) 5 - Inter-Polytechnic level participation
- B) In the semesters where 3 Camps (Energy Conservation Awareness Camp, Entrepreneurship Awareness Camp and Personality Development Camp) are there, the following is suggested:
- a) 5 - for General behavior and Discipline (as above)
 - b) 5 - for Attendance (as above)
 - c) 5 - for NCC/Cultural/Co-curricular/NSS
 - 5 - for National Level
 - 3 - for participation in two of above activities
 - 2 - for Inter-Polytechnic Level

- d) 10 - A Question Paper related to specified Awareness¹⁵
Camp in the Study Scheme may be set by the
Haryana State Board of Technical Education.

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

8. Means of Assessment

The performance of student in each course shall be evaluated through continuous assessment consisting of examinations/tests/quizzes etc. as per the guide lines given in following table

Continuous Assessment Criterion

Examination (Theory)	Syllabus to be covered in the examination	Time Allotted for the examination	Marks	Remarks
Midterm Sessional Test (MST)-I	Up to 33%	1.5 hours	(As per Evaluation Scheme)	Best two tests shall be considered and in any case no special test will be conducted for the students who remained absent in any of the MST. and quizzes etc. constitute internal evaluation
Midterm Sessional Test (MST)-II	33 % to 66%	1.5 hours		
Midterm Sessional Test (MST)-II	66% to 100%	1.5 hours		
Quizzes/Group discussion / Class discussion/ attendance/ seminars / projects/ case studies assignments etc.	As per direction of teacher	As per direction of teacher	5+5 (Assignment + Attendance)	
End Semester Examination	100%	3 hours	(As per Evaluation Scheme)	External Evaluation
Total			(As per Evaluation Scheme)	Marks may be rounded off to nearest integer
Practical				
Daily evaluation of practical records/ Assignment/Viva Voce/ Attendance etc.	(As per Evaluation Scheme)			Internal Evaluation
Final Practical Performance + Viva Voce	100%	3 hours	(As per Evaluation Scheme)	External Evaluation
Industrial Training- After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a period of 4/6 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 organisations				

9. DETAILED CONTENTS OF VARIOUS SUBJECTS

FIRST SEMESTER

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 | 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 | Channels of communication | |
| 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 | Active and passive voice | |
| 2.5 | Synonyms and antonyms | |
| 2.6 | Pair of words | |
| 2.7 | Correction of incorrect sentences | |

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3. Listening (04 hrs.)
- 3.1 Meaning and process of listening
- 3.2 Importance of listening
- 3.3 Methods to improve listening skills
4. Speaking (04 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
- God Lives in the Panch – Munshi Prem Chand The Gift of the Magi – O. Henry
 - Uncle Podger Hangs a Picture – Jerome K. Jerome
- Section – II
- Skylark – P.B. Shelley
 - Stopping by Woods on a Snowy Evening – Robert Frost Where the Mind is Without Fear – Rabindranath Tagore
6. Writing (04 hrs.)
- 6.1 Significance and effectiveness of writing
- 6.2 Paragraph of 100 – 120 words
- 6.3 Picture composition/Guided composition

LIST OF PRACTICALS

1. Self and peer introduction
2. Looking up words in a dictionary (meaning and pronunciation)
3. Newspaper reading
4. Just a Minute session – extempore
5. Situational conversation and role play
6. Using pre – recorded CDs/DVDs to students to listen and comprehend.
7. Greetings for different occasions
8. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Use of pre-recorded CDs/DVDs should be made to help the students in developing listening skills. Student centered activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

LIST OF RECOMMENDED BOOKS

1. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
2. Communicating Effectively in English, Book-I by Revathi Srinivasan; Abhishek Publications, Chandigarh.
3. Professional Communication by Kavita Tyagi & Padma Misra; Published by PHI Learning Pvt. Ltd; New Delhi.
4. Developing Communication Skills (2nd Edition) by Krishna Mohan & Meera Banerji; Published by Macmillan Publishers India Ltd; New Delhi.
5. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
6. Communication Skills by Sanjay Kumar & Pushup Lata; Oxford University Press, New Delhi

Websites for Reference:

1. <http://www.mindtools.com>
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs.)	Marks Allotted (%)
1	Unit 1	12	25
2	Unit 2	12	25
3	Unit 3	04	08
4	Unit 4	04	08
5	Unit 5	12	26
6	Unit 6	04	08

1.2 APPLIED MATHEMATICS – I

L P
5 -

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 logarithm, binomial theorem, partial fractions, matrices etc. for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to

- Apply Complex Number and its representation for two dimensional designing and related calculations. They will be able to apply this knowledge in many engineering problems like alternating current/voltage. The concept of rotation of a vector using iota will enable them solve many engineering problems.
- Apply the basics concepts of Permutation and Combination to find out how many possible ways or arrangements are possible for a particular problem and its solutions. They will be able to count without actual counting. They will be able to apply this concept in understanding of Binomial Theorem and demonstrate better reasoning in different analytical situations.
- Calculate the approximate value of certain expressions and extract roots of certain expression in many engineering problems by Application of Binomial Theorem.
- Resolve a fraction to further fractions by applying basics concepts of Partial Fractions. They will be able to use and apply this knowledge in Integral Calculus.
- Solve engineering problems that are in matrix format by applying the basic understanding of Matrices and their properties, which are usually less computational. Further, this understanding will work as a backbone for the use and development of software in many engineering applications. Study of matrices and its properties will also provide educational base for continuing study and provide solution to many engineering problems by different methodologies.
- Design and solve related problems like constructions of roads, dams, bridges and calculation of height, distance, elevation etc. By the understanding of basic concepts of Trigonometry and 2D geometry, they will be able to apply the same in different situations in surveying, navigation, astronomy and many other engineering problems. They will also be able to draw graphs of trigonometrically functions for many applications in the solution of engineering problems.

- Write the equations of a geometric shape used in many engineering problems such as straight line and circle. With the use of coordinate geometry, they will be able to explore and evaluate the idea of location, graph, linear relationships between two forms, and distance between two lines, which will be useful in solving engineering problems. They will be able to calculate the distance between a point and a line.

DETAILED CONTENTS

1. Algebra (30 hrs.)
 - 1.1 Complex Numbers: Complex number, representation, modulus and amplitude.
 - 1.2 Basics and properties of logarithms.
 - 1.3 Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors).
 - 1.4 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.
 - 1.5 Determinants and Matrices – Expansion of determinants (up to 3rd order, using properties and otherwise), solution of equations (up to 3 unknowns) by Crammer's rule, definition of Matrices with types, addition, subtraction and multiplication of matrices (up to 3rd order), Minors and Co-factors, inverse of a Matrix by Ad joint method (up to 3rd order), solution of simultaneous equations (up to 3rd order) by Matrix method. Area of a triangle using determinants.
2. Trigonometry (25 hrs.)
 - 2.1 Concept of angle, measurement of angle in degrees, grades and radians and their conversions.
 - 2.2 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).
 - 2.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

3. Co-ordinate Geometry

(25 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 standard forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.
- 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

INSTRUCTIONAL STRATEGY

Basic elements of algebra, trigonometry and coordinate geometry 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.

LIST OF RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs.)	Marks Allotted (%)
1.	Unit 1	30	35
2.	Unit 2	25	35
3.	Unit 3	25	30

1.3 APPLIED PHYSICS – I

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4	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 the subject, the student will be able to

- Identify physical quantities, parameters and select their units for use in engineering solutions and make measurements with accuracy by optimising different types of errors.
- Represent physical quantities as scalar and vectors and calculate area of an engineering design and determine net flow (flux) through a given closed surface, etc.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Define work, energy and power and their units. Drive work, power and energy relationship and solve problems about work and power.
- Classify sources of energy as renewable or non-renewable. State the principle of conservation of energy. Give advantages and disadvantages of each energy source and Identify forms of energy, conversions.
- Compare and contrast the physical properties associated with linear motion and rotational motion and give examples of conservation of angular momentum.
- Describe the surface tension phenomenon and its units, cause of surface tension and effects of temperature on surface tension and Solve statics problems that involve surface tension related forces.
- Describe the viscosity of liquids, coefficient of viscosity and the various factors affecting its value. calculate the viscosity of an unknown fluid using Stokes' Law and the terminal velocity

- Define stress and strain. State Hooke's law and conditions under which it is valid. Given an engineering stress-strain diagram, determine (a) the modulus of elasticity, (b) the yield strength (0.002 strain offset), and (c) the tensile strength, and (d) estimate the percent elongation.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin Fahrenheit etc.
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Define the terms: specific heat capacity, specific latent heat, analyse the result of heat transfer between bodies at different temperatures and states measure the specific heat capacity of a solid or a liquid

DETAILED CONTENTS

1. Units and Dimensions (10 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, coefficient of viscosity, stress, strain, moment of inertia, gravitational constant.)
 - 1.3 Principle of homogeneity of dimensions
 - 1.4 Dimensional equations and their applications, conversion from one system of units to other, checking of dimensional equations and derivation of simple equations)
 - 1.5 Limitations of dimensional analysis
 - 1.6 Error in measurement, absolute error, relative error, rules for representing significant figures in calculation.
 - 1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non-metallic blocks, wires, pipes etc. (at least two each).

2. Force and Motion (12 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 and its application to lawn roller.
 - 2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
 - 2.5 Impulse and its Applications
 - 2.6 Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period.

- 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
- 2.8 Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist
- 2.9 Application of various forces in lifts, cranes, large steam engines and turbines.
- 3. Work, Power and Energy (10 hrs.)
 - 3.1 Work: and its units, examples of zero work, positive work and negative work
 - 3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
 - 3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
 - 3.4 Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation
 - 3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
 - 3.6 Power and its units, calculation of power in numerical problems
 - 3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, and car trains etc.
- 4 Rotational Motion (10 hrs.)
 - 4.1 Concept of translatory and rotatory motions with examples
 - 4.2 Definition of torque and angular momentum and their examples
 - 4.3 Conservation of angular momentum (quantitative) and its examples
 - 4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only).
 - 4.5 Application of rotational motions in transport vehicles, and machines.
- 5. Properties of Matter (12 hrs.)
 - 5.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve
 - 5.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
 - 5.3 Surface tension: concept, its units, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension
 - 5.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
 - 5.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications (no derivation and numerical).

6. Thermometry (10 hrs.)
- 6.1 Difference between heat and temperature
 - 6.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 6.3 Different scales of temperature and their relationship
 - 6.4 Types of Thermometer (Mercury Thermometer, Bimetallic Thermometer, Platinum resistance Thermometer, Pyrometer)
 - 6.5 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
 - 6.6 Concept of Co-efficient of thermal conductivity
 - 6.7 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS (to perform minimum eight experiments)

1. To find volume of solid sphere using a Vernier calipers.
2. To find internal diameter and depth of a beaker using a Vernier calipers 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 find the Moment of Inertia of a flywheel about its axis of rotation.
8. To determine the atmospheric pressure at a place using Fortin's Barometer.
9. To determine the viscosity of glycerin by Stoke's method.
10. To determine the coefficient of linear expansion of a metal rod.
11. 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 of mechanics, work power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

LIST OF 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. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi

4. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
5. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
6. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
7. Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar
8. Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1.	Unit 1	10	15
2.	Unit 2	12	20
3.	Unit 3	10	15
4.	Unit 4	10	15
5.	Unit 5	12	20
6.	Unit 6	10	15

1.4 BASICS OF INFORMATION TECHNOLOGY

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RATIONALE

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

Note:

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

LEARNING OUTCOMES

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

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

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application
 - 1.1 Information Technology concept and scope.
 - 1.2 Applications of IT in office, Air and Railway Ticket reservation, Banks financial transactions, E-Commerce and E- Governance applications etc., Ethics of IT, concept of online frauds, threats of IT crimes.
2. Computer Hardware:
 - 2.1 Block diagram of a computer.
 - 2.2 Components of computer system.
 - 2.3 CPU
 - 2.4 Memory
 - 2.5 Input devices; keyboard, Scanner, mouse etc.
 - 2.6 Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory.
 - 2.7 RAM, ROM, magnetic disks – tracks and sectors.
 - 2.8 Optical disk (CD, DVD & Blue Ray Disk.), USB/Flash Drive.
3. Software Concepts:
 - 3.1 System software.
 - 3.2 Application software.
 - 3.3 Virtualization software and Utility software.
 - 3.4 Introduction of Operating System.
 - 3.5 Installation of Window / Linux.
 - 3.6 Features of OPEN OFFICE/MS_OFFICE (MS word, Excel, PowerPoint).
4. Internet Concepts:
 - 4.1 Basics of Networking – LAN, WAN,
 - 4.2 Wi-Fi technologies and sharing of printers and other resources.
 - 4.3 Concept of IP addresses.
 - 4.4 DNS.
 - 4.5 Introduction of internet, applications of internet like: e-mail and browsing, 4.6 Concept of search engine and safe searching.
 - 4.7 Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox.
 - 4.8 WWW (World Wide Web).
 - 4.9 Hyperlinks.
 - 4.10 Introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, name its various components and peripherals. List their functions.
2. Installing various components of computer system and installing system software and application software
3. Installation of I/O devices, printers and installation of operating system viz. Windows/BOSS/ LINUX
4. Features of Windows as an operating system
 - Start
 - Shut down and restore
 - Creating and operating on the icons
 - Opening, closing and sizing the windows and working with windows interfacing elements (option buttons, checkbox, scroll etc.)
 - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file and folders
 - Changing settings like, date, time, colour (back ground and fore ground etc.)
 - Using short cuts
 - Using on line help
5. Word Processing (MS Office/Open Office)
 - a) File Management:
 - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file
 - b) Page set up:
 - Setting margins, tab setting, ruler, indenting
 - c) Editing a document:
 - Entering text, cut, copy, paste using tool- bars
 - d) Formatting a document:
 - Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline method
 - Aligning of text in a document, justification of document, inserting bullets and numbering
 - Formatting paragraph, inserting page breaks and column breaks, line spacing
 - Use of headers, footers: Inserting footnote, end note, use of comments, autotext
 - Inserting date, time, special symbols, importing graphic images, drawingtools
 - e) Tables and Borders:
 - Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
 - Print preview, zoom, page set up, printing options

- Using find, replace options
- f) Using Tools like:
 - Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels.
 - Using shapes and drawing toolbar.
 - Working with more than one window.

6. Spread Sheet Processing (MS Office/Open Office)

- a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets
- b) Menu commands:
Create, format charts, organize, manage data, solving problem by analyzing data.
Programming with Excel Work Sheet, getting information while working
- c) Work books:
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations
Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting
- d) Creating a chart:
Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
Using a list to organize data, sorting and filtering data in list
- e) Retrieve data with query:
Create a pivot table, customizing a pivot table. Statistical analysis of data
- f) Exchange data with other application:
Embedding objects, linking to other applications, import, export document.

7. PowerPoint Presentation (MS Office/Open Office)

- a) Introduction to PowerPoint
 - How to start PowerPoint
 - Working environment: concept of toolbars, slide layout & templates.
 - Opening a new/existing presentation
 - Different views for viewing slides in a presentation: normal, slide
- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
 - Adding text boxes
 - Adding/importing pictures
 - Adding movies and sound
 - Adding tables and charts etc.

- Adding organizational chart
- Editing objects
- Working with Clip Art
- d) Formatting slides
 - Using slide master
 - Text formatting
 - Changing slide layout
 - Changing slide colour scheme
 - Changing background
 - Applying design template
- e) How to view the slide show?
 - Viewing the presentation using slide navigator
 - Slide transition
 - Animation effects, timing, order etc.
- f) Use of Pack and Go Options.

8. Internet and its Applications

- a) Establishing an internet connection.
- b) Browsing and downloading of information from internet.
- c) Sending and receiving e-mail
 - Creating a message
 - Creating an address book
 - Attaching a file with e-mail message
 - Receiving a message
 - Deleting a message
- d) Assigning IP Addresses to computers and use of domain names.

9. Functioning of Antivirus

- a) Installation and updation of an antivirus.
- b) How to scan and remove the virus.

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.

LIST OF RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi.
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi.
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi.
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi.
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
9. On Your Marks- Net...Set...Go... Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi.
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar.

1.5 ENGINEERING DRAWING - I

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

LEARNING OUTCOMES

After undergoing this subject, the student 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

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 AutoCAD (02 sheets)

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

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

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus 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.

LIST OF RECOMMENDED BOOKS

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

1.6 ENVIRONMENTAL STUDIES

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RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Basics of ecology, eco system and sustainable development. (03 hrs.)
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table, rain water harvesting, maintenance of ground water, deforestation – its effects and control measures. (04 hrs.)
3. Pollution: Sources of pollution - natural and manmade, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units

of measurement. Prevention of Pollution: Introduction to Cleaner Production Technologies, Waste Minimization Techniques, Concept of Zero Discharge.

(12 hrs.)

4. Solid waste management, classification of refuse material, sources, effects and control measures. Introduction to E-waste Management. (06 hrs.)
5. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA). (08 hrs.)
6. Energy Conservation: Introduction to Energy Management, Energy Conservation, Energy efficiency & its need. Introduction to Energy Conservation Act 2001 and Energy Conservation (Amendment) Act 2010 & its importance. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) in environmental protection. (10 hrs.)
7. Impact of Energy Usage on Environment: – Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings. (05 hrs.)

INSTRUCTIONAL STRATEGY

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

LIST OF RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	03	05
2	Unit 2	04	08
3	Unit 3	12	25
4	Unit 4	06	12
5	Unit 5	08	18
6	Unit 6	10	22
7	Unit 7	05	10

1.7 GENERAL WORKSHOP PRACTICE – I

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RATIONALE

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

LEARNING OUTCOME

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

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

DETAILED CONTENTS (PRACTICAL EXERCISES)

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

The following shops are included in the syllabus:

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

1. WELDING SHOP - I

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

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

2. FITTING SHOP – I

- 2.1 Use of personal protective equipment and safety precautions while working.
- 2.2 Basic deburring processes.
- 2.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
- 2.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminum etc.)
- 2.5 Identification of various steel sections (flat, angle, channel, bar etc.).
- 2.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

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

3. SHEET METAL SHOP – I

- 3.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
- 3.2 Introduction and demonstration of hand tools used in sheet metal shop.
- 3.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Turning Machine, Wiring Machine, Setting Down Machine, Forming

Machine, Brake etc.

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

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

Job I Shearing practice on a sheet using hand shears.

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

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

4. ELECTRIC SHOP – I

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

- 4.2 Study of electrical safety measures and protective devices.

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

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

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

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

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

- 4.5 Introduction to battery charger and its functioning.

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

5. ELECTRONIC SHOP – I

- 5.1 Identification and familiarization with the following tools used in electronic shop: Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Philips Screw Driver (Star Screw Driver), L- Keys, Soldering Iron and their demonstration and uses.

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

5.2.1. Various types of single, multi-cored insulated screened power, audio video, co-axial, general purpose wires/cables.

5.2.2. Various types of plugs, sockets connectors suitable for general purpose audio and video use, 2 and 3 pin mains plug and sockets. Banana-plugs, and sockets, BNG, RCA, DIN, UHF, Ear phone

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

5.2.3. Various types of switches such as normal/miniature toggle, slide, push button, piano key, rotary, micro switches, SPST, SPDT, DPST, DPDT, band selector, multi way Master Mains Switch.

5.2.4. Various types of protective devices such as: Wire fuse, cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multiple circuit breakers, over and under current relays.

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 desoldering.
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.
Job IV	Identification and familiarisation with various types of switches, protective devices such as- wire fuse, cartridge fuse etc. and relays.
Job V	Safety precautions to be observed in the electronic shops.

6. COMPUTER SHOP – I

EXERCISE – I

6.1 Keyboard

- Types of Keyboards.
- Interfacing (PS2, USB port, DIN connector) Working Repairing.

6.2 Mouse

- Types of Mouse.
- Interfacing (serial, PS2, USB) Working.

EXERCISE – II

6.3 Printers

- Types (Dot matrix, Inkjet, Laserjet)
- Interfacing (parallel port, USB port, Networking) Working
- Maintenance (cartridge change etc.) Installation of printer
- Troubleshooting (Driver compatibility, Paper jam, printing problems due

to uncleaned drum in laserjet printers, belt related problems in inkjet printer, jets choking problem in inkjet printer, color alignment problem).

- Tracing network printer and sharing it.

EXERCISE – III

64 Scanner

- Types
- Interfacing.
- Scanning a document.

65 Monitor

- Types and Interfacing.
- Fault finding and repairing.

EXERCISE – IV

66 CPU

- Motherboard connection (dimensions, processor, chipset, BIOS, EFI (Extended Firmware Interfacing), UFI (Unified Firmware Interfacing)).
- SMPS-AT
 - Working
 - Voltage levels
 - Fault finding and repair

LIST OF RECOMMENDED BOOKS

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

STUDENT CENTERED ACTIVITIES

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

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

SECOND SEMESTER

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 OUTCOME

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 List of words misspelt | |
| | 1.3 Prefixes and Suffixes | |
| | 1.4 Punctuation | |
| | 1.5 Narration | |
| | 1.6 Idioms and Phrases | |
| 2. | Reading | (12 hrs.) |
| | Comprehension, Vocabulary enrichment and grammar exercises based on the following readings: | |

Section-I

- The Refund - Frietz Karinthy
- Riders to the Sea - J.M. Synge

Section-II

- Night of the Scorpion - Nissim Ezekiel
- Palanquin Bearers - Sarojini Naidu
- Ode on a Grecian Urn – John Keats

3. Writing (24 hrs.)

- 3.1 Precis Writing
- 3.2 Correspondence: Business and Official
- 3.3 Report Writing: Project report
- 3.4 Press Release
- 3.5 Memos and Circulars
- 3.6 Notices, Agenda and Minutes of Meetings
- 3.7 Filling-up different forms such as bank form and on-line form for placement etc.

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Seminar
4. Debate
5. Use of recorded CDs of speeches for comprehension.
6. Manners and etiquettes
7. Paper presentation
8. Telephonic conversation: General etiquette for making and receiving calls.

INSTRUCTIONAL STRATEGY

Use of pre-recorded CDs/DVDs should be made to help the students in developing listening skills. Student centered activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

LIST OF RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.

2. Professional Communication by Kavita Tyagi & Padma Misra; Published by PHI Learning Pvt. Ltd; New Delhi.
3. Developing Communication Skills (2nd Edition) by Krishna Mohan & Meera Banerji; Published by Macmillan Publishers India Ltd; New Delhi.
4. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
5. Business correspondence and report writing by RC Sharma and Krishna Mohan; Tata McGraw Hill, New Delhi.
6. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
7. Communication Skills by Sanjay Kumar & Pushp Lata; Oxford University Press, New Delhi.

Websites for Reference:

1. <http://www.mindtools.com>
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	12	25
2	Unit 2	12	25
3	Unit 3	24	50

2.2 APPLIED MATHEMATICS – II

L	P
5	-

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus and Integral calculus and Operations Research 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:

- Calculate the effect of one variable with respect to another variable and write the equation of tangent and normal to a curve at a point by understanding and application of basics concepts of derivatives. After understanding the concept of derivatives they will be able to calculate the maximum and minimum values of a function.
- Calculate the area of a curve bounded by axes, by understanding the applications of basic concepts of integration. They will also be able to find the velocity from acceleration and displacement from velocity.
- Evaluate complex integrals in a simpler way by applying definite integral.
- Calculate the approximate area under a curve by applying Numerical Integration by using Trapezoidal and Simpson's Rules.
- Optimize the utilization of limited resources by applying basics concepts of Linear Programming.
- Solve Engineering and Industrial Problems by understanding and applying the solution of differential equations.
- Apply differential Equations and Numerical methods for higher learning of Mathematics and Engineering Applications.

DETAILED CONTENTS

- | | | |
|-----|--|-----------|
| 1. | Differential Calculus | (26 hrs.) |
| 1.1 | Definition of function; Concept of limits (Introduction only). | |
| 1.2 | Standard Differentiation of x^n , $\sin x$, $\cos x$, $\tan x$, e^x , $\log_a x$ and related formule. | |
| 1.3 | Differentiation of sum, product and quotient of functions, differentiation of | |

implicit functions, differentiation of parametric functions. Differentiation of function of a function.

- 1.4 Differentiation of trigonometric, inverse trigonometric functions. Logarithmic differentiation. Exponential differentiation, Successive differentiation (excluding nth order).

- 1.5 Application of differential calculus in:

- (a) Rate Measures
- (b) Maxima and minima
- (c) Equation of tangent and normal to a curve (for explicit functions only)

2. Integral Calculus (30 hrs.)

- 2.1 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).

$$\text{Evaluation of } \int_0^{\pi/2} \sin^n x \, dx, \int_0^{\pi/2} \cos^n x \, dx, \int_0^{\pi/2} \sin^m x \cos^n x \, dx$$

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 problem).

- 2.6 Numerical integration by Trapezoidal Rule and Simpson's $1/3^{\text{rd}}$ Rule and $3/8^{\text{th}}$ Rule.

3. Operations Research (12 hrs.)

- 3.1 Linear Programming Problems formulations.

- 3.2 Graphical Method

4. Differential Equations (12 hrs.)

- 4.1 Definition, order, degree of ordinary differential equations.

- 4.2 Formation of differential equation (upto 2^{nd} order). Solution of Differential equations with Variable separation and Linear Differential equations.

INSTRUCTIONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus, Operations research 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.

LIST OF RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi.
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar.
3. Applied Mathematics, Vol. I & II by SS Sabharwal & Dr Sunita Jain, Eagle Parkashan, Jalandhar.
4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi.
5. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd., Delhi.
6. Applied Mathematics I, Archana Sharma, Lords Publications, Jalandhar.
7. Engineering Mathematics by Srimanta Pal and Subodh C. Bhunia; Oxford University Press, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	26	34
2	Unit 2	30	38
3	Unit 3	12	16
4	Unit 4	12	12

2.3 APPLIED PHYSICS – II

L	P
4	2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims 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 OUTCOME

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

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave. They will be able to explain diffraction, interference, polarization.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect.
- State the laws of reflection and refraction of light, calculate the location of the final image for a concave mirror single thin converging lens, design and assemble a microscope using 2 lenses.
- Measure the refractive index of a liquid or a solid. They will be able to explain total internal reflection as applied to optical fibers.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using $C=Q/V$.
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain electric current as flow of charge, the concept of resistance, measure correctly, using a multimeter, the following: electric current, potential difference, resistance.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field.
- Explain how the following operate: moving coil galvanometer, simple DC motor.
- Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits.

- Use the knowledge of semiconductors in various technical gadgets like mobile phones, computers, LED, LCD, solar lights etc.
- Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Apply the use of optical fiber in Medical field and optical fiber Communication.

DETAILED CONTENTS

1. Wave motion and its applications (08 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 Wave equation $y = r \sin wt$, phase, phase difference, principle of superposition of waves.
 - 1.3 Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M. concept of simple harmonic progressive wave.
 - 1.4 Study of vibration of Cantilever and determination of its time period.
 - 1.5 Free, forced and resonant vibrations with examples.
 - 1.6 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications.
 - 1.7 Ultrasonics – Introduction and their engineering and medical applications.
2. Optics (10 hrs.)
 - 2.1 Laws of reflection and refraction, refractive index, lens 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.
 - 2.4 Applications of Total Internal Reflection in optical fiber, uses of microscope and telescope.
3. Electrostatics (12 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 Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.
- 3.4 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numerical).
- 3.5 Dielectric and its effect on capacitance, dielectric break down.
- 3.6 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only).

4. Current Electricity (12 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, Colour coding of carbon Resistances.
- 4.3 Ohm's law and its verification, superconductivity.
- 4.4 Kirchhoff's laws, Wheatstone bridge and its applications (slide Wire Bridge only).
- 4.5 Concept of terminal potential difference and Electro motive force (EMF).
- 4.6 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy.
- 4.7 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.

5. Electromagnetism (10 hrs.)

- 5.1 Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with their properties.
- 5.2 Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and their units.
- 5.3 Concept of electromagnetic induction, Faraday's Laws.
- 5.4 Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field.
- 5.5 Moving coil galvanometer its principle, construction and working. Conversion of a galvanometer into ammeter and voltmeter.

- 5.6 Application of electromagnetism in ac/dc motors and generators.
6. Semiconductor physics (06 hrs.)
- 6.1 Energy bands, Types of materials (insulator, semiconductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics.
- 6.2 Diode as rectifier – half wave and full wave rectifier (centre taped), semiconductor transistor; pnp and npn (concept only).
- 6.3 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.
7. Modern Physics (06 hrs.)
- 7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.
- 7.2 Fiber optics: introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture and applications in communication.
- 7.3 Introduction to nanotechnology, nanoparticles and nano materials.

LIST OF PRACTICALS (To perform minimum Eight experiments)

1. To find the time period of a simple pendulum.
2. To determine and verify the time period of Cantilever.
3. To find the focal length of convex lens by displacement method.
4. To determine the magnifying power of an astronomical telescope.
5. To verify ohm's laws by drawing a graph between voltage and current.
6. To verify laws of resistances in series and parallel combination.
7. To find resistance of galvanometer by half deflection method.
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To measure very low resistance and very high resistances using Slide Wire bridge
10. To draw characteristics of a pn junction diode and determine knee and break down voltages.
11. Use of CRO in plotting AC and DC waveforms.
12. To find wave length of the laser beam.
13. To find numerical aperture of a plastic optical fiber.

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 of waves, sound, light, electrostatics, dc circuits, electromagnetism, and semiconductor physics etc to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

LIST OF RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi.
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi.
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi.
4. Practical Physics, by C. L. Arora, S Chand publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (hrs.)	Marks Allotted (%)
1	Unit 1	08	12
2	Unit 2	10	16
3	Unit 3	12	18
4	Unit 4	12	18
5	Unit 5	10	16
6	Unit 6	06	10
7	Unit 7	06	10

2.4 BASIC ELECTRONICS

L	P
4	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 and insulators, extrinsic and intrinsic semi-conductors, p-n junction, need of rectifiers, significance and use of filters in rectifiers, basic structure and working principle of tunnel diodes, LEDs, reactor diodes, LCD; working of transistors in various configurations; fundamental knowledge of FETs and MOSFETs etc. and their applications. The teacher should give emphasis on understanding of concepts by explaining the various terms used in the subject. Practical exercises have been included in order to reinforce various concepts. Industrial/field exposure must be given by organizing industrial visit.

LEARNING OUTCOMES

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

- Identify and able to take readings on various electronics equipment's (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.
- Fabricate 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.

DETAILED CONTENTS

1. Semiconductor Physics: (12 hrs.)
 - 1.1 Review of basic atomic structure and energy levels, concept of insulators, conductors and semiconductors, atomic structure of Germanium (Ge) and Silicon (Si), covalent bonds
 - 1.2 Concept of intrinsic and extrinsic semiconductor, process of doping.
 - 1.3 Energy level diagram of conductors, insulators and semiconductors; minority and majority charge carriers.
 - 1.4 P-type and N-type semiconductors and their conductivity, effect of temperature

on conductivity of intrinsic semiconductors.

2. Semiconductor Diode: (12 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, static and dynamic resistance and their value calculation from the characteristics.
 - 2.3 Application of diode as half-wave, full wave and bridge rectifiers. Peak Inverse Voltage, rectification efficiencies and ripple factor calculations, 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: (12 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; input and output dynamic resistance 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: (06 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: (10 hrs.)
 - 5.1 Single stage transistor amplifier circuit.
 - 5.2 Concept of dc and ac load line and its use.
 - 5.3 Explanation of phase reversal of output voltage with respect to input voltage.
6. Field Effect Transistors (12 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. (No 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. Design of following circuit on breadboard and observe the output of :
 - a) Half-wave rectifier circuit using one diode.
 - b) Full-wave rectifier circuit using two diodes.
 - c) Bridge-rectifier circuit using four diodes.
6. Plotting of the wave shape of full wave rectifier with
 - a) Shunt capacitor filter.
 - b) Series inductor filter.
 - c) RC filter.
7. Plotting of input and output characteristics and calculation of parameters of transistors in CE configuration.
8. Plotting of input and output characteristics and calculation of parameters of transistors in CB configuration.
9. Plotting of V-I characteristics of a FET based amplifier.
10. Measurement of voltage gain, input and output impedance in a single state CE amplifier circuit.

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 students.

LIST OF RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd., New Delhi.
2. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi.
3. Electronic Components and Materials by SM Dhir, Tata McGraw Hill Education Pvt Ltd., New Delhi.
4. Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi.
5. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.
6. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill Education Pvt Ltd., New Delhi.
7. Basic Electronics – Problems and Solutions by Albert Malvino and David J. Bates; Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.
8. Basic Electronics by J.S. Katre, Sandeep Bajaj, Tech. Max. Publications, Pune.
9. Analog Electronics by DR Arora, Ishan Publications, Ambala City.
10. Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi.
11. Analog Electronics by JC Karhara, King India Publication, New Delhi
12. Electrical Devices and Circuits by Rama Reddy, Narosa Pulishing House Pvt. Ltd., New Delhi.
13. Electronic Devices and Circuits by Dharma Raj Cheruku and Battula Tirumala Krishna: Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92.
14. Basic Electronics by JB Gupta, SK Kataria and Sons, New Delhi.
15. Grob's Basic Electronics- A text Lab Manual (Special Indian Edition) by Schultz, Tata McGraw Hill Education Pvt Ltd, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	12	20
2	Unit 2	12	20
3	Unit 3	12	20
4	Unit 4	6	5
5	Unit 5	10	15
6	Unit 6	12	20

2.5 BASIC ELECTRICAL ENGINEERING

L	P
4	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Overview of DC Circuits (06 hrs.)
 - 1.1 Simple problems on series and parallel combination of resistors with their wattage consideration.
 - 1.2 Application of Kirchhoff's current law and Kirchhoff's voltage law to simple circuits. Star – Delta connections and their conversion.
2. DC Circuit Theorems (06 hrs.)
 - 2.1 Thevenin's theorem.

- 2.2 Norton's theorem.
- 2.3 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. Electro Magnetic Induction (10 hrs.)
 - 4.1 Concept of electro-magnetic field produced by flow of electric current, magnetic circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit.
 - 4.2 Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced e.m.f, simple numerical problems.
 - 4.3 Concept of current growth, decay and time constant in an inductive (RL) circuit.
 - 4.4 Energy stored in an inductor, series and parallel combination of inductors.
- 5. Batteries (06 hrs.)
 - 5.1 Basic idea of primary and secondary cells
 - 5.2 Construction, working principle and applications of Lead-Acid, Nickel-Cadmium and Silver-Oxide batteries
 - 5.3 Charging methods used for lead-acid battery (accumulator)
 - 5.4 Care and maintenance of lead-acid battery
 - 5.5 Series and parallel connections of batteries
 - 5.6 General idea of solar cells, solar panels and their applications
 - 5.7 Introduction to maintenance free batteries
- 6. AC Fundamentals (10 hrs.)
 - 6.1 Concept of alternating quantities.
 - 6.2 Difference between AC and DC.
 - 6.3 Concepts of: cycle, frequency, time period, amplitude, instantaneous value, average value, R.M.S. value, maximum value, form factor and peak factor.
 - 6.4 Representation of sinusoidal quantities by phasor diagrams.
 - 6.5 Equation of sinusoidal wave form for an alternating quantity and its derivation.
 - 6.6 Effect of alternating voltage applied to a pure resistance, pure inductance.

and pure capacitance.

7. AC Circuits (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.
8. Various Types of Power Plants (06 hrs.)
 - 8.1 Brief explanation of principle of power generation practices in thermal, hydro and nuclear power stations and their comparative study. A Visit to a nearby Power Station(s) may be organized for better understanding and exposure.
 - 8.2 Elementary block diagram of above mentioned power stations.

LIST OF PRACTICALS

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

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

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.

LIST OF RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal, Tata Mc Graw-Hill Education Pvt Ltd., New Delhi.
2. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Co, New Delhi.
3. Electrical Technology, Fifth Edition by Edward Hughes, Longman Publishers.
4. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.
5. Electrical Science by Choudhury S.; Narosa Publishing House Pvt Ltd, Daryaganj, New Delhi.
6. Basic Electrical and Electronics Engineering by Kumar KM, Vikas Publishing House Pvt Ltd, Jang pura, New Delhi.
7. Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
8. Basic Electricity by BR Sharma; Satya Prakashan; New Delhi.
9. Principles of Electrical Engineering by BR Gupta, S Chand and Co, New Delhi.
10. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi.
11. Experiments in Basic Electrical Engineering by GP Chhalhotra, Khanna Publishers, New Delhi
12. Basic Electrical Engineering by J.S. Katre, Technical Max. Publication, Pune.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1.	Unit 1	06	8
2.	Unit 2	06	10
3.	Unit 3	04	08
4.	Unit 4	10	15
5.	Unit 5	06	12
6.	Unit 6	10	15
7.	Unit 7	16	20
8	Unit 8	06	12

2.6 GENERAL WORKSHOP PRACTICE – II

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- 6

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. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labor, precision, safety at work places, team working and right attitude among the students will also be met.

LEARNING OUTCOME

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

- Follow safety procedures and measures.
- Maintain good housekeeping practices.
- 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 using at least the resources of three shops and compare the job with the specifications given.
- 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.

DETAILED CONTENTS (PRACTICAL EXERCISES)

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

The following shops are included in the syllabus:

1. Welding Shop – II
2. Fitting Shop – II
3. Sheet Metal Shop – II
4. Electric Shop – II
5. Electronic Shop – II
6. Computer Shop – II

1. WELDING SHOP - II

- 1.1 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.
- 1.2 Jobs to be prepared:

Job I	Identification and adjustment of various types of gas flames.
Job II	Preparation of lap joint on 75 mm × 35 mm × 3mm M.S. plate using gas welding.
Job III	Preparation of butt joint on 75mm×35mm×3mm M.S.flat using gas welding process.
Job IV	Preparation of a small cot frame (M.S. steel bed frame) from M.S. conduit pipe using arc/gas welding process.
Job V	Preparation of a square pyramid from M.S. rod by welding (Arc or Gas welding).
Job VI	Practice of Spot/Seam welding.

2. FITTING SHOP - II

- 2.1 Care and maintenance of various measuring tools.
- 2.2 Handling of measuring instruments, finding least count and checking of zero error.
- 2.3 Description and demonstration of various types of drills, taps and dies.
- 2.4 Selection of dies for threading, selection of drills and taps.
- 2.5 Precautions while drilling soft metals (Aluminium, Copper, Brass etc.).
- 2.6 Introduction to various types of threads (internal, external, single start, multi-start, left hand and right hand threads).

Job I	Drilling practice on soft metals-Aluminium or Copper or Bronze.
Job II	Preparation of a job by filing on nonferrous metals upto an accuracy of $\pm .1$ mm.
Job III	Making internal and external threads on a job (GI Pipe, PVC pipe, Steel bars etc.) by tapping and dieing operations (manually) and fixing of different types of elbow, tee, union,

socket.

3. SHEET METAL SHOP - II

- 3.1 Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing
- 3.2 Introduction to soldering and brazing.
- 3.3 Introduction to metal spinning process.
 - Job I Preparation of job involving shearing, circular shearing, rolling, folding, beading and soldering process e.g. Funnel or any other job involving above operations.
 - Job II Exercise on job involving brazing process.
 - Job III Spinning a bowl/cup/saucer.
 - Job IV Visit to a sheet metal industry e.g. coach builders etc.

4. ELECTRIC SHOP- II

- 4.1 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply and wiring system.
 - Job I Laying 3 phase wiring for an electric motor or any three phase machine.
- 4.2 Estimating and costing of power consumption
 - Job II Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.
 - Job III Finding faults in electric circuits, machines, with series testing lamp and multimeter.
- 4.3 Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.
 - Job IV Dismantling, servicing and reassembling of any of the above electrical appliances.
- 4.4 Testing and reversing direction of rotation of single phase and three phase motors.
 - Job V Testing single phase/three phase motors by using voltmeter, ammeter and tachometer.
 - Job VI Reversing direction of rotation of single phase and three phase motors.

5. ELECTRONIC SHOP - II

- 51 Identification and familiarization with the following electronic instruments:
- Multimeter analog and digital (Three and half digit)
 - Single beam simple CRO, Signal Generator and Function Generator; function of every knob on the front panel
 - Audio-oscillator having sine and square wave output
 - Regulated Power supply -- fixed voltage and variable voltage, single output as well as dual output.
- 52 Identification and familiarization with active and passive components; colour code and types of resistor, capacitors and potentiometers (including VDR, LDR, and thermistor). Identification of components including LED, LCD, UJT, FET, Coils, transformers (mains, audio and RF, etc.), MOSFET, SCR, DIAC, TRIAC, Photodiode and Photo transistor.
- 53 Job Practice
- | | |
|---------|--|
| Job I | Use of multimeters to test components and measurement of circuits, voltage, and resistance. |
| Job II | Use of familiarization with CRO, signal generator, function generator and Audio oscillator. |
| Job III | To make regulated power supply on general purpose PCB. |
| Job IV | Identification and familiarization of datasheets of the following components: UJT, FET, MOSFET, SCR, DIAC, TRIAC, Photodiode and Photo transistor. |
| Job V | Safety precautions to be observed in the electronic shop. |

6. COMPUTER SHOP – II

EXERCISE - I

- 61 Optical Devices
- CD-R, DVD, CD-W
 - Working
 - Copying
 - CD/DVD drives
 - Pen drive (copying data, formatting scanning)
- 62 Microphones and Speakers
- Types and Interfacing

EXERCISE – II

63 Projectors

- Types
- Settings
- Interfacing

64 Hard disks

- Different makes of Hard disks
- Retrieval of Hard disk data

65 Graphic Card connection

66 Sound Card Connection

EXERCISE – III

67 Different types of network interface cards, cables such as data cables, printer cables, network cables, power cables etc.

68 Networking tools such as cutter, connector (RJ45)

69 Network Cable

- Straight Cable
- Cross Cable
- Roll Cable

EXERCISE – IV

6.10 Types of cables

- UTP Cables: CAT3, CAT5, CAT6, CAT7
- Fiber optic cable
- Structured cabling

LIST OF RECOMMENDED BOOKS

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

STUDENT CENTERED ACTIVITIES

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 Labelling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Haryana 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

THIRD SEMESTER

NON-CONVENTIONAL MANUFACTURING PROCESSES

RATIONALE

L	P
4	0

This unit familiarizes you with different kind of Non-Conventional manufacturing processes used in the industry for high quality surface finish, high precision and speed of machining process.

LEARNING OUTCOMES

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

- Describe and explain different Manufacturing techniques.
- Explain their working Principle behind these machines.

DETAILED CONTENTS

(8 hrs)

1. UNIT – I

Introduction: Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities.

(24 hrs)

2. UNIT - II

Unconventional Machining Process: Principle, Working, Process parameters and applications of unconventional machining process such as Electro-Discharge machining, WEDM, Chemical machining, Electro-chemical machining, Ultrasonic machining, Abrasive jet machining, Abrasive flow machining, Water jet machining, Laser beam machining, Electron beam machining, IBM and other advanced manufacturing processes.

(12 hrs)

3. UNIT – III

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma arc welding/cutting etc.

(20 hrs)

4. UNIT-IV

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro Discharge forming, water hammer forming, explosive compaction etc. Electronic-device manufacturing: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.

INSTRUCTIONAL STRATEGY

1. The teacher must explain the scientific principal behind all the mentioned machining processes with real life applications and examples.

LIST OF RECOMMENDED BOOKS

1. P.C. Pandey& H.S. Shan, “Modern Machining Process”, Tata McGraw Hills, 2001.
2. Amitabh Gosh and A.K. Mallik, “Manufacturing Science”, Affiliated East-West Press Pvt. Ltd., 1985.
3. J.T. Black, Ronald A. kosher DeGarmo's Materials and Processes in Manufacturing, 11th Edition ,Wiley.
4. Mikell P. Groover" Principles of Modern Manufacturing, 5th Edition SI Version, Wiley.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted in (Hrs)	Marks Allotted In (%)
1	UNIT - I	(8 hrs)	15
2	UNIT - II	(24 hrs)	40
3	UNIT – III	(12 hrs)	20
4	UNIT-IV	(20 hrs)	25

3.1 Mobile and Wireless Communication

L	P
3	2

RATIONALE

Contents of this course provide fundamental base for understanding Wireless Communication which includes Evolution of 2G/3G/4G/5G spectrums and CDMA, OFDM and LTE. This exposure will enable the students to enter their professions with confidence in communication field.

Learning Outcomes

- Understand fundamentals of communication.
- Type of communication and its evolution.
- Analyse the Mobile radio propagation, fading, diversity concepts and the channel modelling.
- Analyse the design parameters, link design, smart antenna, beam forming and MIMO systems.
- Analyse Multiuser Systems, CDMA network planning and OFDM Concepts.
- Summarize the principles and applications of wireless systems and standards.

Detailed Contents

(12 hrs)

1. **Unit I** - Overview of Cellular Systems Evolution 2G/3G/4G/5G Cellular Concepts – Frequency reuse, Co channel and Adjacent channel Interference

(12 hrs)

2. **Unit II** - Wireless propagation Link budget, Free-space path loss, Noise figure of receiver Multipath fading, Shadowing, Fading margin, Shadowing margin

(12 hrs)

3. **Unit III** - Antenna diversity, wireless channel capacity and MIMO

(12 hrs)

4. **Unit IV** - Overview of CDMA, OFDM and LTE

PRACTICAL EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

1. To understand the cellular frequency reuse concept to find the co-channel cells for a particular cell. I 04
2. To understand the path loss II 04 .
3. Understand the path loss with shadowing II 04
4. Understanding the Flat fading II 04.
5. Understanding the Frequency selective fading II 04
6. Understanding the Multipath channel for the following objectives
 1. No Fading
 2. Flat Fading
 3. Dispersive Fading II 04
7. To simulate a dipole antenna (λ , $\lambda/4$, $\lambda/2$, $3\lambda/2$) for a particular frequency using 4NEC2 III 04
8. Perform following experiments using CDMA trainer kit:
 1. PSK modulation and demodulation experiment.

2. Bit synchronization extraction experiment
3. Error correction encoding experiment

LIST OF RECOMMENDED BOOKS

- 1 “Wireless Communications – Principles and Practice” T. S. Rappaport, (2nd edition) Pearson ISBN 9788131731864
- 2 “Modern Wireless Communications” Haykin & Moher Pearson 2011 (Indian Edition)

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted in (hrs)	Marks Allotted in (%)
1	UNIT - I	12	25
2	UNIT - II	12	25
3	UNIT – III	12	25
4	UNIT-IV	12	25

3.3 Electric Power Transmission and Distribution

75

L	P
4	4

RATIONALE

Contents of this course provide knowledge of Electrical Power Transmission and its Distribution in different Loads. Types of different distribution schemes: radial, ring, and grid, layout, advantages, disadvantages and applications. This exposure will make students understand the working of power grid and transmission lines.

LEARNING OUTCOME

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Interpret the normal operation of the electric transmission and distribution systems.
- Maintain the functioning of the medium and high voltage transmission system.
- Interpret the parameters of the extra high voltage transmission system.

DETAILED CONTENTS

(12hrs)

1. Unit – I Basics of Transmission and Distribution

- 1.1 Single line diagrams with components of the electric supply transmission and distribution systems.
- 1.2 Classification of transmission lines: Primary and secondary transmission; standard voltage level used in India.
- 1.3 Classification of transmission lines: based on type of voltage, voltage level, length and others Characteristics of high voltage for power transmission.
- 1.4 Method of construction of electric supply transmission system – 110 kV, 220 kV, 400 kV.
- 1.5 Method of construction of electric supply distribution systems – 220 V, 400V, 11 kV, 33 kV.

(12 hrs)

2. Unit – II Transmission Line Parameters and Performance

- 2.1 Line Parameters: Concepts of R, L and C of line parameters and types of lines.
- 2.2 Performance of short line: Efficiency, regulation and its derivation, effect of power factor, vector diagram for different power factor.
- 2.3 Performance of medium line: representation, nominal 'T', nominal ' π ' and end condenser methods.
- 2.4 Transposition of conductors and its necessity.
- 2.5 Skin effect and proximity effect.

(14 hrs)

3. Unit– III Extra High Voltage Transmission

- 3.1 Extra High Voltage AC (EHVAC) transmission line: Necessity, high voltage substation components such as transformers and other switchgears, advantages, limitations and applications and lines in India. Ferranti and Corona effect.
- 3.2 High Voltage DC (HVDC) Transmission Line: Necessity, components, advantages, limitations and applications. Layout of mono polar, bi-Polar and homo-polar transmission lines. Lines in India.
- 3.3 Features of EHVAC and HVDC transmission line.

3.4 Flexible AC Transmission line: Features, d types of FACTS controller. New trends in wireless transmission of electrical power.

(14 hrs)

4. Unit– IV A.C Distribution System

- 4.1 AC distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system.
- 4.2 Feeder and distributor, factors to be considered in design of feeder and distributor.
- 4.3 Types of different distribution schemes: radial, ring, and grid, layout, advantages, disadvantages and applications.
- 4.4 Voltage drop, sending end and receiving end voltage.
- 4.5 Distribution Sub-Station: Classification, site selection, advantages, disadvantages and applications.
- 4.6 Single Line diagram (layout) of 33/11KV Sub-Station, 11KV/400V sub-station, Symbols and functions of their components.

(12 hrs)

5. Unit– V Components of Transmission and Distribution Line

- 5.1 Overhead Conductors: Properties of material, types of conductor with trade names, significance of sag.
- 5.2 Line supports: Requirements, types of line structures and their specifications, methods of erection.
- 5.3 Line Insulators: Properties of insulating material, selection of material, types of insulators and their applications, causes of insulator failure, derivation of equation of string efficiency for string of three suspension insulator, methods of improving string efficiency.
- 5.4 Underground Cables: Requirements, classification, construction, comparison with overhead lines, cable lying and cable jointing.

LIST OF PRACTICALS

Laboratory work is not applicable for this course.

Following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Prepare a report based on transmission line network in Haryana.
- b. Collect the information on components of transmission line.
- c. Evaluate transmission line performance parameters of a given line.
- d. Library/ Internet survey of electrical high voltage line and HVDC lines.
- e. Visit to 33/11 KV and 11KV/400V Distribution Substation and write a report

Also one micro-project can be assigned to the student. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

Prepare a model showing:

- i. Single line diagram of electric supply system.
- ii. Single line diagram of a given distribution system.
- iii. Short line and medium transmission line.
- iv. Write a report on the same by giving the details of lines in Haryana State.

References:

1. G.C. Garg, Utilization of Electric Power & Electric Traction, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-355) .
2. Mehta, V.K., Principles of Power System, S. Chand and Co. New Delhi, ISBN: 9788121924962.
3. Soni;Gupta; Bhatnagar, A Course in Electrical Power, DhanpatRai and Sons New Delhi, ISBN: 9788177000207 .
4. Gupta,J.B., A Course in Power Systems, S.K. Kataria and sons, New Delhi, ISBN: 9788188458523
5. Theraja, B.L.; Theraja, A.K., A Textbook of Electrical Technology Vol. III, S.Chand and Co. New Delhi, ISBN : 9788121924900 .
6. Uppal,S.L., A Course in Electrical Power, S.K.Khanna Publisher New Delhi, ISBN : 9788174092380 .
7. Sivanagaraju S.; Satyanarayana S., Electrical Power Transmission and Distribution, Pearson Education, New Delhi, , ISBN:9788131707913 .
8. Ned Mohan, Electrical Power System: A First Course, Wiley India Pvt. Ltd. New Delhi, ISBN:9788126541959 .
9. Gupta, B.R., Power System Analysis and Design, S. Chand and Co. New Delhi, ISBN: 9788121922388 .
10. Kamraju, V., Electrical Power Distribution System, Tata McGraw-Hill, New Delhi, ISBN:9780070151413.

Topic No.	Topics	Time Allotted in (Hrs)	Marks Allotted in (%)
1	Unit 1	12	20
2	Unit 2	12	25
3	Unit 3	14	25
4	Unit 4	14	20
5	Unit 5	12	10

3.4 Electronic Instrumentation

L	P
3	2

RATIONALE

This subject deals with the construction and working of various transducers which sense various parameters and control operations in industry. A diploma holder looking after the operations of various instruments and gadgets is required to diagnose faults, rectify them and ensure the best performance from the system. Thus, there is a need of introducing diploma holders to the basics of instrumentation.

LEARNING OUTCOMES

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

- Understand the construction and working principle of various transducers used for Displacement measurement, Force and Torque measurement, Temperature measurement, Pressure measurement.
- Understand the working principle of various transducers which are used to measure displacement using wire wound potentiometer and LVDT.
- Apply the working principle of strain gauges and load cell to measure the force and torque which are used for control operations in industry.
- Differentiate various temperature measurement transducers such as bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermistors and pyrometers.
- Use various transducers which are used for measuring the non-electrical quantities such as humidity, pH, liquid level, viscosity and vibrations.
- Understand the components of data acquisition system and concept of acquiring the data from transducers/input devices

DETAILED CONTENTS

1. Measurements (3 hrs.)
Importance of measurement, basic measuring systems, advantages and limitations of each measuring systems and display devices.
2. Transducers (6 hrs.)
Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type).
3. Measurement of Displacement and Strain (6 hrs.)
Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor, gauge materials and their selections. Use of

electrical strain gauges, strain gauge bridges and amplifiers.

4. Force and Torque Measurement (6 hrs.)
Different types of force measuring devices and their principles, load measurements by using elastic transducers and electrical strain gauges. Load cells, measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.
5. Pressure Measurement (5 hrs.)
Bourdon pressure gauges, electrical pressure pick ups and their principle, construction and applications. Use of pressure cells.
6. Flow Measurement (4 hrs.)
Basic principles of magnetic, ultrasonic flow meters and laser Doppler
7. Measurement of Temperature (5 hrs.)
Bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermistors and pyrometer. Temperature recorders
8. Measurement of other non electrical quantities such as humidity, pH, liquid level, sound level, viscosity and vibration. (5 hrs.)
9. Data Acquisition system: (4 hrs.)
Input amplifiers, signal conditioners, output amplifiers.
10. Output Devices and Displays: (4 hrs.)
Basic principles of operation, construction features and application of LED, LCD displays, Graphic Recorder, X-Y recorder, Computer Monitor

PRACTICAL EXERCISES

1. To measure the level of a liquid using a transducer
2. To measure temperature using a thermo-couple
3. Study and use of digital temperature controller
4. Use of thermistor for temperature measurement
5. Study of variable capacitive transducer
6. Draw the characteristics of a potentiometer
7. To measure linear displacement using LVDT
8. To study the use of electrical strain gauge
9. To study weighing machine using load cell
10. To study pH meter.
11. Measurement and plotting the characteristics of photo diodes
12. To assemble and test instrumentation amplifier to find out its gain, input and output impedance
13. Measurement of flow rate
14. Measurement of pressure using Bourdon Tube
15. Study X- Y recorder/ graphic recorder

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical applications in the field. The transducers and measuring devices must be shown to the students and they should be trained in the reaction, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students.

LIST OF RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad.
2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi.
3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi.
4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi.
5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (hrs.)	Marks Allocation (%)
1	Unit 1	3	6
2	Unit 2	6	12
3	Unit 3	6	12
4	Unit 4	6	12
5	Unit 5	5	12
6	Unit 6	4	8
7	Unit 7	5	12
8	Unit 8	5	10
9	Unit 9	4	8
10	Unit 10	4	8

3.5 COMPUTER PROGRAMMING AND APPLICATION

L	P
2	4

RATIONALE

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

LEARNING OUTCOMES

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

- Understand the basic knowledge of fundamentals of programming, steps in development of a program, algorithms and programming technologies.
- Use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming.
- Understand the execution of programs and debugging of the code written in C language.
- Differentiate the concept of various control statements such as if-else, while, do-while, for, switch and break statements which are very helpful for embedded C language also
- Use the various computer applications related to electronics engineering branch such as ORCAD, PSPICE, MATLAB.
- Develop logics which will help them to create programs and applications in C and after learning the basic programming, students can easily switch over to any other language in future.

DETAILED CONTENTS

1. Algorithm and Program Development (04 hrs.)
 - 1.1 Steps in development of a program
 - 1.2 Flow-charts, algorithm development
 - 1.3 Approaches Towards Programming
 - 1.4 Introduction to various computer languages high level language(HLL), machine language (ML) and Assembly Language
 - 1.5 Introduction to Translators: Assembler, Compiler, Interpreter
- 2 Fundamentals of C Programming (24 hrs.)
 - 2.1 Overview of C:

History of 'C', Features and Characteristics, Structure of C, Header Files.

2.2 I/O statements

Input output statements, Assignment statements, Variables, Constants, Data Types Operators & Expressions with their precedence, Standard Formatted and Unformatted I/O Functions.

2.3 Control Structures

Decision and Loop Statements: if-else, while, do- while, for loops, breaks, switch statements.

2.4 Functions:

Introduction to Functions, Function declaration and definition, parameter passing- Call by value-Call By Reference, storage class Specifies, Local and Global Variables, standard library functions, Recursion.

2.5 Arrays:

Introduction to Array, Array Declaration and Initialization, Single and multi-dimensional Arrays, character arrays.

2.6 Pointers:

Introduction to Pointers, Declaration and Initialization, Address Operators & Pointers To various data types, pointers in parameters passing, pointers to function.

2.7 Structures:

Declaration & Definition of a structure, pointer to structure, union and array of structure, Self Referential Structures.

2.8 Strings:

String processing, functions and standard library function.

2.9 Data files

File handling and manipulation, file reading and writing, Binary and ASCII files, file records using standard function type mouse.

- 3 Software Applications in Electronics Engineering (04 hrs.) Computer application overview through various applications software related to Electronics Engineering branch viz: ORCAD, PSPICE, OPTSIM, KEIL, Circuit Maker, MATLAB, Electronic Workbench.

LIST OF PRACTICALS

1. Programming exercise on executing a C Programs.
2. Programming exercise on editing a C program.
3. Programming exercise on defining variables and assigning values to variables.
4. Programming exercise on arithmetic and relation operators.
5. Programming exercise on arithmetic expressions and their evaluation.
6. Programming exercise on reading a character.

7. Programming exercise on writing a character
8. Programming exercise on formatting input using print.
9. Programming exercise on formatting output using scan.
10. Programming exercise on simple IF statement.
11. Programming exercise on IF... ELSE statement.
12. Programming exercise on SWITCH statement.
13. Programming exercise on GOTO statement.
14. Programming exercise on DO-WHILE statement.
15. Programming exercise on FOR statement.
16. Programming exercise on one dimensional arrays.
17. Programming exercise on two dimensional arrays.
18. Demonstration of Application Software such as MATLAB, PSPICE, OPTSIM etc.

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Programming in C by Balagurusamy, Tata McGraw Hill Education Pvt. Ltd, New Delhi.
2. Programming in C by Gottfried, Tata McGraw Hill Education Pvt. Ltd, New Delhi.
3. Let us C- Yashwant Kanetkar, BPB Publications, New Delhi.
4. Computer Programming and Applications by Preeti Chhabra, Ishan Publication.
5. Programming in C by R Subburaj, Vikas Publishhing House Pvt. Ltd., Jangpura, New Delhi.
6. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi.
7. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi.
8. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi.
9. Programming in Applications by Chandershekhar, Unique International Publications, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Unit 1	4	15
2.	Unit 2	24	70
3.	Unit 3	4	15

3.6 COMPUTER AIDED DRAFTING

L	P
-	7

RATIONALE

The students of diploma programme must have the competency in preparing the drawings with the help of CAD which will be useful while working in the industry.

LEARNING OUTCOMES

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

- Understand the AutoCAD workspace, user interface and using basic drawing, editing, and viewing tools.
- Add text, hatch, dimensions and more advanced editing and construction techniques.
- Use advanced plotting, publishing options and annotative styles and objects.
- Use field settings in objects, blocks, attributes and authoring tools and setting parameters and constraints.
- Insert, define and edit attribute values, sharing drawings using drawing sets.
- Create, publish and customize sheets and sheet sets, understand CAD standards and using 3D viewing techniques.
- Work with simple and composite solids and creating complex solids and surfaces.
- Set up a rendering with materials and lights, create 2D drawings from 3D models.
- Work with the User Coordinate System.

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction to AutoCAD commands (6 drawing sheets)
 - 1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar)
 - 1.2 Drawing commands – point, line, arc, circle, ellipse,
 - 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
 - 1.4 Dimensioning and placing text in drawing area
 - 1.5 Sectioning and hatching
 - 1.6 Inquiry for different parameters of drawing entity
2. Detail and assembly drawing of the following using AUTOCAD (4 sheets)
 - 2.1 Plummer Block

- 2.2 Wall Bracket
 - 2.3 Stepped pulley, V-belt pulley
 - 2.4 Flanged coupling
 - 2.5 Machine tool Holder (Three views)
 - 2.6 Screw jack or knuckle joint
3. Isometric Drawing by CAD using Auto CAD (one sheet)
Drawings of following on computer:
 - Cone
 - Cylinder
 - Isometric view of objects
 4. Modelling (01 sheet)
3D modelling, Transformations, scaling, rotation, translation.
 5. Introduction to other CAD softwares;
(Pro Engineer/CATIA / Inventor/Unigraphics/Solid Work: Salient features, simple drawing of components (2 D and 3D)(At least one software).
 6. Introduction of E-CAD Advantage of E-CAD Application of E-CAD Software Exploration.
 7. Toolbars, Tool Pallets, Insert Component, Working With Project Manager, Implement Layers ,Text Wire & Ladder, Trim, Parent-Child Component Discussion, Multiple Wire Bus & Edit Component, Forward Reverse Control Circuit, Star Delta Control Circuit , Star Delta Control Power Circuit, Forward Reverse Control Circuit, Star Delta Control Circuit , Star Delta Control Power Circuit Attribute, Scoot ,Move, Dash-link, Reverse and Flip Schematic Report and insert PLC module in drawing Circuit Designs using E-CAD.

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the component/part whose drawing is to be made.
2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
3. Teachers should ensure use of IS codes related to drawing.

RECOMMENDED BOOKS

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.
6. Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi.

DRUGS USE AND ABUSE AWARENESS CAMP

Unit 1 Drugs Use and Abuse in Society

- a. Concept and overview
- b. Extent of the problem
- c. Drug use as a social problem
- d. Causes of Drug Use: Biological, Socio-cultural, psychological

Unit 2 Types of Dugs and identification of Abuse

- a. Familiar drugs: Tobacco, Caffeine, over the counter drugs
- b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
- c. Performance enhancing the drugs
- d. Uppers and Downers: Stimulants and Depressants

Unit 3 Impact of drug Abuse

- a. Individual level biological and psychological
- b. Family social, National

Unit 4 Management and prevention of Drug Abuse

- a. Medical and psychological
- b. Role of family School, Media and Legislation

FOURTH SEMESTER

4.1 DIGITAL ELECTRONICS

L	P
4	2

RATIONALE

The objective of this subject is to enable the students to know the basic concepts of digital electronics and gain familiarity with the available IC chips. The students will learn about number systems, logic gates, various codes, parities, Boolean algebra, mux and demux, flip-flop, counters, shift registers. This will form a broad base for studying digital system design, advanced microprocessors and further studies.

LEARNING OUTCOMES

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

- Define digital and analog signals and need of digitization and applications of digital systems.
- Explain fundamental concepts of the number system (Binary Decimal, Octal, Hexadecimal, BCD) and convention from one number system to another.
- Demonstrate how voltage levels are used to represent digital quantities and describe various parameters of a pulse waveform.
- Explain the basic logic operations of NOT, AND, OR, NAND, NOR, and XOR and will be able to interpret logic functions, circuits, truth tables, and Boolean algebra expressions.
- Apply the laws of Boolean algebra to simplify circuits and methods of systematic reduction of Boolean algebra expressions using Karnaugh maps.
- Use the methods of systematic reduction of Boolean algebra expressions including Karnaugh maps.
- Design various combination circuits such as Adders, Subtractors, Multiplexers, Demultiplexers, Encoders and Decoders which are used in digital system design.
- Understand concepts of sequential circuits and to analyse sequential systems by designing of various sequential logic circuits such as Flip-Flops, Shift Registers and Counters.

DETAILED CONTENT

- | | | |
|----|--|-----------|
| 1. | Introduction | (02 hrs.) |
| | 1.1 Distinction between analog and digital signal. | |
| | 1.2 Applications and advantages of digital signals | |
| 2. | Number Systems | (08 hrs.) |
| | 2.1 Decimal, binary, octal, hexadecimal number systems | |

- 2.2 Conversion of number from one number system to another including decimal points
- 2.3 Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction
- 2.4 BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa
- 2.5 Concept of parity, single and double parity, error detection and correction using parity
- 2.6 Alpha numeric codes: ASCII, EBCDIC and Unicode

- 3. Logic Gates (07 hrs.)
 - 3.1 Logic gates, positive and negative logic, pulse waveform, definition, symbols, truth tables, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates
 - 3.2 NAND and NOR as universal logic gates
 - 3.3 Introduction to TTL and CMOS logic families and their sub classifications.

- 4. Logic Simplification (06 hrs.)
 - 4.1 Rules and laws of Boolean algebra, logic expression,
 - 4.1.1.1 Demorgan's theorems, their proof
 - 4.2 Sum of products form (minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra
 - 4.3 Karnaugh mapping techniques upto 4 variables and their applications for simplification of Boolean expression

- 5. Arithmetic Circuits (06 hrs.)
 - 5.1 Half adder and Full adder circuit, design and implementation.
 - 5.2 Half and Full subtractor circuit, design and implementation.
 - 5.3 4 bit adder/subtractor.
 - 5.4 Adder and Subtractor IC (7484)
 - 5.5 2-bit comparator

- 6. Decoders, Multiplexer and DE-multiplexer (06 hrs.)
 - 6.1 Basic functions and block diagram of Encoders and decoders.
 - 6.2 Basic functions and block diagram of Multiplexers and De-Multiplexers. Different types and ICs.
 - 6.3 Four bit decoder circuits for 7 segment display and decoder/driver ICs.

7. Latches and flip flops (06 hrs.)
 - 7.1 Concept and types of latch with their working and applications.
 - 7.2 Operation using waveforms and truth tables of RS, T, D, JK flip flops.
 - 7.3 Master/Slave JK flip flops.
 - 7.4 Difference between a latch and a flip flop.
 - 7.5 Flip flop ICs.
8. Shift Register (07 hrs.)
 - 8.1 Introduction and basic concepts including shift left and shift right.
 - 8.2 Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
 - 8.3 Universal shift register
 - 8.4 Buffer register, Tristate Buffer register
 - 8.5 IC 7495
9. Counters (08 hrs.)
 - 9.1 Introduction to Asynchronous and Synchronous counters
 - 9.2 Binary up/down counters (upto MOD-8)
 - 9.3 Decade counter.
 - 9.4 Pre settable and programmable counters
 - 9.5 Ring counter with timing diagram
 - 9.6 Counter ICs
10. Analog to Digital and Digital to Analog Converters (08 hrs.)
 - 10.1 Working principle of A/D and D/A converters
 - 10.2 Detail study of :
 - Binary Weighted D/A converter
 - R/2R ladder D/A converter
 - 10.3 Brief idea about different techniques of A/D conversion and study of :
 - Stair step Ramp A/D converter
 - Dual Slope A/D converter
 - Successive Approximation A/D Converter
 - 10.4 Performance characteristics of A/D and D/A converter.
 - 10.5 Applications of A/D and D/A converter.
 - 10.6 Finite state machine-
 - capabilities and limitations,
 - Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines,
 - Partition techniques and merger chart methods-concept of minimal cover table.
11. Algorithmic State Machine:
 - 11.1 Representation of sequential circuits using ASM charts synthesis of output and next state functions,

11.2 Data path control path partition-based design.

LIST OF PRACTICALS

1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate.
2. Verification of NAND and NOR gate as universal gates.
3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation.
4. Verify the operation of:
 - a) multiplexer using an IC
 - b) de-multiplexer using an IC
5.
 - a) Verify the operation of BCD to decimal decoder using an IC.
 - b) Verify the operation of BCD to 7 segment decoder using an IC.
6. Verify operation of SR, JK, D-flip-flop master slave JK flip-flop using IC.
7. Verify operation of SISO, PISO, SIPO, PIPO shift register. (Universal shift register).
8. Verification operation of ring counter.
9. Testing of digital ICs using IC tester.
10. Asynchronous Counter ICs.

Verification of truth table for any one universal shift register IC.

Use of IC 7490 or equivalent TTL (a) divide by 2 (b) divide by 10 Counter

OR

Use of IC 7493 or equivalent TTL (a) divide by 2 (b) divide by 8 (c) divide by 16 counter

LIST OF RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill, New Delhi.
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi.
3. Digital Fundamentals by Thomas Floyds, Universal Book Stall.
4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi.
5. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi.
6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala.
7. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi.
8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi.
9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi.

INSTRUCTIONAL STRATEGY

The Digital Electronic – 1 has significant importance in the field of Electronics. Adequate competency need to be developed by giving sufficient practical knowledge in microprocessor, A/D, D/A, convertors and other topics. Help may be taken in the form of charts, simulation packages to teach of the subject.

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER
SETTER**

Topic Number	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Unit 1	2	5
2	Unit 2	8	10
3	Unit 3	7	15
4	Unit 4	6	10
5	Unit 5	6	10
6	Unit 6	6	10
7	Unit 7	6	10
8	Unit 8	7	10
9	Unit 9	8	10
10	Unit 10	8	10

4.2 DC and AC MACHINES

L	P
4	2

RATIONALE

This subject deals with various types of electrical machines being employed in industry, power stations, domestic and commercial appliances etc. It is envisaged that after studying the subject, students will gain competence in operation, repair and maintenance of such machines and give suggestions for improvement in their performance. The students will study three phase supply, transformer, a.c. and d.c. motors. The practicals will enable students to perform various tests necessary for installation and commissioning of such machines.

LEARNING OUTCOMES

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

- Understand the three phase supply, advantages of three phase supply over single phase supply and also knowing about the knowledge of power factor and its importance.
- Demonstrate the knowledge about the principle, working of DC generator, Construction of D.C. Generator emf equation of D.C. Generator and armature Reaction.
- Get the knowledge about the principle and working of DC motor with controlling and its starting method. Also knowing about its application.
- Understand the three phase induction motor with its principle, working, construction, starting method and its application.
- Analysis the synchronous motor with its principle, working, construction, starting method, effect of load and excitation on synchronous motor and its application.
- Classify the single phase motor Principle, construction, working speed, control, starting and applications of the following i.e. induction motor and universal motor.
- Get the knowledge about the Principle of Alternator, Construction of Alternator emf equation of Alternator.
- Understand the stepper motor and servo motor with its principle, working, construction, and its application.

DETAILED CONTENTS

- | | | |
|----|---|---------|
| 1. | Three Phase Supply | (06hrs) |
| | 1.1. Advantages of 3 phase system over single phase system. | |
| | 1.2. Star delta connections. | |

1.3. Relation between phase voltage and line voltage, phase current and line current in a 3 phase system.

1.4. Power and power factor(p.f.) in 3 phase system and their measurements, importance of p.f. (simple problems).

2. D.C. Generators (08 hrs.)
Principle of D.C. Generator, Construction of D.C. Generator e.m.f. equation of D.C. Generator, Armature Reaction.
3. DC Motor (08 hrs.)
Principle, significance of back emf, types of motors and their construction, motor characteristics for shunt and series, speed control of DC motors and factors controlling the speed. Starting methods, construction and working of 3 point starter, applications (simple problems).
4. Three Phase Induction Motors (10 hrs.)
Principle, construction, concept of slip, torque and characteristics, effect of motor resistance on torque (running and starting), rotor current, output power, different methods of speed control. Starting methods and constructional and working of 3-point starter, applications (simple problems).
5. Synchronous Motors (08 hrs.)
Principle, construction and working, effect of load and excitation on synchronous motor. Starting of motor and their applications.
6. Single Phase Motors (08 hrs.)
Principle, construction, working speed, control, starting and applications of the following motors:
a) Induction motor
b) Universal motor
7. Alternators (08 hrs.)
Principle of Alternator: Construction of Alternator emf equation of Alternator.
8. Stepper Motor and Servo Motor (08 hrs.)
Types, construction, working and their applications (**Note:** No derivation of any formula).

LIST OF PRACTICALS

The students to perform following experiments in the lab:

1. DC machines
 - 1.1 Speed control of dc shunt motor (i) Armature control method (ii) Field control method.
 - 1.2 Study of dc series motor with starter (to operate the motor on no load for a moment).
2. To measure power and power factors in 3 - phase load using two wattmeter methods.
3. To connect a dc shunt motor with supply through 3 - phase starter and to run the motor at different speed with the help of a field regulator.
4. To run a 3 - phase squirrel cage Induction motor with the help of a star delta starter.
5. To change the direction of rotation of induction motor.
6. To run a synchronous motor with a.c. supply and to measure speed to verify the relation $N_s = 120F/P$

INSTRUCTIONAL STRATEGY

For conceptual understanding a field/industrial visit (preferably Transformer Factory) may be organized 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, where the teacher can give an idea of the working of the factory without much seeking assistance of the factory staff. In addition, emphasis may be given on field applications and simple numerical problems.

LIST OF RECOMMENDED BOOKS

- 1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi.
- 2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi.
- 3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi.
- 4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar.
- 5) Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi.
- 6) Electrical Machines by DR Arora, Ishan Publications, Ambala city.
- 7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topic	Time Allotted (hrs.)	Marks Allocation
1.	Unit 1	6	12
2.	Unit 2	8	12
3.	Unit 3	8	12
4.	Unit 4	10	18
5.	Unit 5	8	12
6.	Unit 6	8	12
7.	Unit 7	8	12
8.	Unit 8	8	12

4.3 EMBEDDED SYSTEMS

L	P
4	3

RATIONALE

The study of microprocessors in terms of architecture, software and interfacing techniques leads to the understanding of working of CPU in a microcomputer. The development in advance microprocessors brings diploma students face-to-face with sophisticated systems in industry. Knowledge of microprocessors and microcontrollers will help them find employment in R&D, assembly, repair and maintenance of hardware of embedded systems. Microprocessors find application in process control industry. They also form a part of the electronic switching system between source and destination in long distance telecommunications. Automation industries often use microcontrollers to introduce programmable control in their operations.

LEARNING OUTCOMES

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

- Understand the role of embedded systems in industry and basic design concept of embedded systems.
- Describe the general architecture of a microcomputer system & organization of 8085 Microprocessor.
- Understand the instruction set of 8085 Microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
- Explain the difference between microprocessor and microcontroller and describe architecture and operation of microcontroller 8051 by developing various programs.
- Write the program in assembly language and Embedded C language using a software Keil μ Vision and able to differentiate which programming language is easy to write.
- Interface different types of external interfaces including LEDs, LCD, Switches, seven segment display, DC and stepper motors which are going to help them to design various projects using 8051 Microcontroller.

DETAILED CONTENTS

1. Evolution of Microprocessor (04 hrs.)

- 1.1 Typical organization of a microcomputer system and functions of its various blocks.
- 1.2 Microprocessor, its evolution, function and impact on modern society.

2. Architecture of a Microprocessor (with reference to 8085 Microprocessor) (10 hrs.)
 - 2.1 Concept of Bus, bus organization of 8085.
 - 2.2 Functional block diagram of 8085 and function of each block.
 - 2.3 Pin details of 8085 and related signals.
 - 2.4 De-multiplexing of address/data bus generation of read/write control signals.
 - 2.5 Steps to execute a stored programmes.
3. Programming (with respect to 8085 microprocessor) (10 hrs.)
 - 3.1 Brief idea of machine and assembly languages.
 - 3.2 Machines and Mnemonic codes.
 - 3.3 Instruction format and Addressing mode.
 - 3.4 Identification of instructions as to which addressing mode they belong.
 - 3.5 Concept of Instruction set.
 - 3.6 Explanation of the instructions of the following groups of instruction set.
 - Data transfer group.
 - Arithmetic Group.
 - Logic Group.
 - Stack I/O and Machine Control Group.
 - 3.7 Programming exercises in assembly language. (Examples can be taken from the list of experiments).
4. Interrupts (08 hrs.)
 - 4.1 Concept of Interrupts.
 - 4.2 Maskable and non-maskable interrupts.
 - 4.3 Edge triggered and level triggered Interrupts.
 - 4.4 Software interrupt, Restart interrupts and its use.
 - 4.5 Various hardware interrupts of 8085.
5. Architecture of a Microcontroller (8051) (10 hrs.)
 - 5.1 Block diagram of 8051.
 - 5.2 Flag Register (PSW).
 - 5.3 8051 Microcontroller Pin Description.
6. Basic of Embedded C Programming (10 hrs.)
 - 6.1 Comparison of C and Embedded C
 - 6.2 Data Types and Keywords used in embedded C for 8051.

6.3 Structure of Embedded C program.

6.4 Timer operation.

6.5 Serial Communication.

7. Interfacing of various peripherals with 8051 (12 hrs.)

7.1 Led and Switch.

7.2 Seven Segment Display.

7.3 LCD.

7.4 Relay.

7.5 DC Motor.

7.6 Stepper motor.

LIST OF PRACTICALS

1. Familiarization of different keys of 8085 microprocessor kit and its memory map.
2. Steps to enter, modify data/program and to execute a programme on 8085 kit.
3. Writing and execution of ALP for addition and subtraction of two 8 bit numbers.
4. Writing and execution of ALP for arranging 10 numbers in ascending/descending order.
5. Interfacing exercise on 8255 like LED display control.
6. Write a program to toggle the LED of PORT 1 Continuously.
7. Write a program for displaying the number from '0 to F' on 7-segment display.
8. Write a program to display your organization name on 16X2 LCD.
9. Write a program to control the direction of DC motor using L293D.
10. Write a program to control the stepper motor using ULN2003 motor driver.

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). Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the given in the list may be given to the students.

LIST OF RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and Applications with 8080/8085 by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi.
2. Microprocessor and Microcontrollers by Dr BP Singh, Galgotia Publications, New Delhi.

3. Microprocessor and Applications by Badri Ram: Tata McGraw Hill Education Pvt Ltd, New Delhi.
4. Microprocessor and Microcomputers by Refiquzzaman, Prentice Hall of India Ltd., New Delhi.
5. 8051 Microcontroller by Ayla K. J; Pearson, New Delhi.
6. 8051 Microcontroller and Embedded Systems by Mazidi, M.A.; Pearson, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topic	Time Allotted (Hrs)	Mark Allotted (%)
1	Unit 1	4	6
2	Unit 2	10	16
3	Unit 3	10	16
4	Unit 4	8	12
5	Unit 5	10	16
6	Unit 6	10	16
7	Unit 7	12	18

4.4 ELECTRICAL AND ELECTRONIC INSTRUMENTATION AND MEASUREMENT

L	P
3	3

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. During practical sessions, he will acquire the requisite skills.

LEARNING OUTCOMES

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

- Understand the basics of measurements with Measurement, methods 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.
- Demonstrate about the - Types of electrical measuring instruments Indicating, Integrating and recording type instruments - Essentials of indicating instruments: Deflecting, controlling and damping torque.
- Classify the measurement of voltage, current and resistance with Principles of operation and construction of permanent magnet moving coil (PMMC) instruments - Moving iron type instruments, measurement of dc voltage and current, measurement of dc voltage and current, and mills-volt measurement. Block diagram, working principle, application and comparison of Analog and Digital Multimeter.
- Enhance the knowledge about the Construction and working of Cathode Ray Tube (CRT) - Block diagram, description of a basic CRO and triggered sweep oscilloscope, front panel controls. - Specifications of CRO and their explanation.
- Explain of block diagram specifications of low frequency and RF generators, pulse generator, function generator - Wave analyzer, distortion measurement and spectrum analyzer.
- Analyze AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge - Block diagram description of laboratory type RLC bridge, specifications of RLC bridge

DETAILED CONTENTS

1. Basics of Measurements (02 hrs.)

Measurement, methods 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. Introduction to Electrical Measuring Instruments (06 hrs.)
 - 2.1 Types of electrical measuring instruments, Indicating, Integrating and recording type instruments
 - 2.2 Essentials of indicating instruments: Deflecting, controlling and damping torque
3. Voltage Current and Resistance Measurement (10 hrs.)
 - 3.1 Principles of operation and construction of permanent magnet moving coil (PMMC) instruments
 - 3.2 Moving iron type instruments, measurement of d.c voltage and current, measurement of d.c voltage and current, milli-volt measurement. Block diagram, working principle, application and comparison of Analog and Digital multimeter
 - 3.3 Specifications of multimeter and its applications
 - 3.4 Limitations with regard to frequency and input impedance.
4. Cathode Ray Oscilloscope (10 hrs.)
 - 4.1 Construction and working of Cathode Ray Tube(CRT)
 - 4.2 Block diagram, description of a basic CRO and triggered sweep oscilloscope, front panel controls.
 - 4.3 Specifications of CRO and their explanation.
 - 4.4 Measurement of voltage, current, frequency, time period and phase using CRO.
 - 4.5 CRO probes, special features of dual beam, dual trace, and delay sweep.
 - 4.6 Digital storage oscilloscope (DSO): block diagram and working principle.

5. Signal Generators and Analytical Instrument (06 hrs.)
- 5.1 Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator.
- 5.6 Wave analyzer, distortion measurement and spectrum analyzer.
6. Impedance Bridges and Q Meters (06 hrs.)
- 6.1 Wheat stone bridge
- 6.2 AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge
- 6.3 Block diagram description of laboratory type RLC bridge, specifications of RLC bridge
- 6.4 Block diagram and working principle of Q meter
- 6.5 Study of LCR meter and its applications.
7. Digital Instruments (06 hrs.)
- 10.1 Comparison of analog and digital instruments
- 10.2 Working principle of ramp, dual slope and integration type digital voltmeter
- 10.3 Measurement of time interval, time period and frequency using universal, counter/frequency counter
- 10.1 Working principle of logic probe, logic pulser, logic analyzer, logic, comparator, signature analyzer
08. Other Measuring Instruments (02 hrs.)
- Construction, working Principle and applications of
- (a) Meggar (b) Earth tester (c) Tong Tester

LIST OF PRACTICALS

1. Measurement of voltage, resistance, frequency, using digital multimeter
2. Measurement of voltage, frequency, time period and phase using CRO.
3. Measurement of rise time and fall time using CRO.
4. Measurement of Q of a coil and its dependence on frequency.
5. Measurement of voltage, frequency, time and phase using DSO.
6. Measurement of resistance and inductance of coil using RLC Bridge.
7. Use of logic pulser and logic probe.
8. Measurement of time period, frequency, average period using universal counter/frequency counter.
9. To measure the value of earth resistance using earth tester.
10. To find the value of unknown resistance lay Wheat Stone Bridge.

11. Measurement of voltage, current, frequency with CRO / multimeter using PC interfacing techniques.

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.

LIST OF RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi.
2. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi.
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi.
5. Electrical Measurement and Measuring Instruments by S.K Sahdev; Unique International Publications, Jalandhar.
6. Electronics Instrumentation by Umesh Sinha; Satya Publications, New Delhi.
7. Electrical Measurement of Measuring Instruments by M.L Anand; S.K Kataria and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (hrs.)	Marks Allocation
1.	Unit 1	02	4
2.	Unit 2	06	12
3.	Unit 3	10	22
4.	Unit 4	10	22
5.	Unit 5	06	12
6.	Unit 6	06	12
7.	Unit 7	06	12
8.	Unit 8	02	4

4.5 HYDRAULIC AND PNEUMATIC SYSTEMS

L	P
4	3

RATIONALE

The subject deals with basic concepts of hydraulic and pneumatics which are required by students for automation purpose. This subject enhances the knowledge and skills of students in the area of hydraulics and pneumatics.

LEARNING OUTCOMES

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

- Define the basic law of hydrostatic and hydrodynamics, advantage and disadvantage of hydraulic & pneumatic systems.
- Identify & use of hydraulic elements like pipes & its layout, hydraulic pumps, control valves, hydraulic actuators and service unit.
- Define compressible fluid, its type, properties & application.
- Identify & use of pneumatic pipes, air compressor, pneumatic cylinders, air motors, pneumatic valves and service unit elements.
- Design and apply the use of hydraulic and pneumatic circuits.

DETAILED CONTENTS

- | | | |
|---|--|-----------|
| 1 | Introduction | (8 hrs.) |
| | Need, scope and importance of hydraulic and pneumatic, Hydrostatic and hydrodynamic definitions, properties of fluid, Pascal's law, Continuity equation and Bernoulli's equation. Advantages and limitations of hydraulic and pneumatic systems. | |
| 2 | Hydraulic Elements | (20 hrs.) |
| | 2.1 Hydraulic Pipes- Type, materials, designations, pressure ratings and selection criteria. | |
| | 2.2 Piping Layout, Concept, rules/norms. | |
| | 2.3 Hydraulic Pump- Type, construction, working applications and selection criteria. Powerpack | |

- 2.4 Control Valves- Type, designation, symbols, working and applications.
- 2.5 Hydraulic Actuators- Type, working and applications.
- 2.6 Other Elements such as filters, manifold, receivers, coolers and connectors.
- 3. Fundamentals of Pneumatics (6 hrs.)
 - 3.1 Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications.
- 4. Pneumatic Elements (4 hrs.)
 - 4.1 Pipes- Type, designations, applications and properties.
 - 4.2 Air Compressor- Type (Reciprocating and rotary), working and selection criteria.
 - 4.3 Pneumatic Cylinders- Type, symbol, cushion, assemblies, mounting and installation.
 - 4.4 Air Motors- Type, working and applications.
 - 4.5 Pneumatic Valves- Type, symbols, working, applications and selection criteria.
 - 4.6 Other elements - Air receivers, filters, pressure regulator, lubricator.
- 5. Hydraulic and Pneumatic Circuits (10 hrs.)
 - 5.1 Concept, Meaning and ISO symbols, Basic hydraulic and pneumatic circuits-Type, circuit diagrams.
 - 5.2 Rules/ Norms for designing hydraulic and pneumatic circuits.

LIST OF PRACTICALS

1. Study and demonstration of various hydraulic devices/elements.
2. Study and demonstration of various pneumatic devices/elements.
3. Operate hydraulic circuits based on simple system requirement. (at least 3)
4. Operate, pneumatic circuit based on simple systems requirements (at least 3)
5. Visit to a related industry.

INSTRUCTIONAL SRATEGY

1. Teacher should lay emphasis in making the students conversant with concepts and principles of hydraulic and pneumatic systems.
2. Various hydraulic and pneumatic elements should be demonstrated during teaching.

LIST OF RECOMMENDED BOOKS

1. Hydraulics and Pneumatics (A Technician and Engineer Guide) by Andrew Parr; Butterworth Publishers.
2. Hydraulic and Pneumatic Systems by S. R Majumdar; TMH Publishers.
3. Mechatronics by W. Bolton; Pearson.
4. Hydraulic and Hydraulic Machines by R. K. Bansal
5. Industrial Pneumatic control by Z. J Lansky; Marcel Dekker, Inc.
6. Hydraulic and Pneumatic Power and control Design, Performance and Application by Yeaple; McGraw hill.
7. Pneumatic Controls: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel- Verlag

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (hrs.)	Marks Allotted(%)
1	Unit 1	8	15
2	Unit 2	20	30
3	Unit 3	6	10
4	Unit 4	20	30
5	Unit 5	10	15

4.6 MECHATRONICS - DESIGN AND DRAFTING

L P
6

RATIONALE

A diploma holder when employed in an automated plant, power station or a manufacturing unit using automation is expected to read, interpret and understand Instrumentation/Mechatronics drawings. In the proposed course, the students will learn to make and simulate instrumentation/ process/automation drawing. The operation of the plant/automated machines can be understood by reading a sequential flow diagram or a process diagram. Making drawings using software packages allows easy simulation of the complete electromechanical system.

LEARNING OUTCOME

After undergoing this subject, the student will be able to

- Understand the basic use of hydraulics and pneumatics components, actuators, pumps & gauges.
- Use of computer aided instrumentation drafting and design.
- Draw sequential flow diagrams, control of sequences and functional boxes.
- Create and edit diagram using hydraulic & pneumatic symbol and also simulate the process.
- Create a live project using PLC, electro pneumatic and electro hydraulic components.
- Write PLC program in ladder and also design the graphics of HMI.

DETAILED CONTENTS

1. Symbols of control valves, actuators, hydraulics and pneumatic components, sources actuators, control elements, pumps, gauges. (6hrs)
2. Introduction to a typical computer aided instrumentation drafting and design package. Design environment configuration, File menu, edit menu, view menu, Layout menu. (10 hrs.)
3. Sequential flow diagrams (SFC) (12 hrs.)
Basic SFC, Creating/drawing SFC, Configuration and animations using SFC, Understanding SFCs structure, control sequences, Functional Boxes.
4. Diagram Editor: (12 hrs.)
Creating and editing diagrams using inbuilt component libraries, configuring the

diagram editor, Simulation of a simple hydraulic/ pneumatic circuit.

5. Creating a project: (10 hrs.)
Configuring the project and diagram settings, map locator, creating a simple circuit simulation.
6. Fluid (Hydraulic and Pneumatic) diagrams- control valves, gauges, actuators, sources, pumps, accumulators, proximity sensors. (10 hrs.)
7. Electromechanical drawings: (14 hrs.)
Terminals, fastener relays, solenoids, cable drawings, protection components (fuse, circuit breaker, thermal protection element).
8. Ladder Logic diagrams, symbology, creation of LLDs, rungs Simulation. (10 hrs.)
9. Panel drawing: (10 hrs.)
Placement of Display (Touch Panel), HMI Control Switches.
10. Wiring diagrams and tags. (12 hrs.)

Instructional Strategy

This course is to be covered with the help of a software package and through practice session on computers.

STUDENT CENETERED ACTIVITIES

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.

INDUSTRIAL TRAINING

Industrial training, 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.

For this purpose, students at the end of fourth semester need to be sent for industrial training for 4/6 weeks duration to be organised during the semester break starting after IV 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 teacher may guide a group of 4-5 students. 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 V 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. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry. 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% |

FIFTH SEMESTER

5.1 CNC MACHINES AND AUTOMATION

L	P
3	4

RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

LEARNING OUTCOMES

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

- Understand the concept and working of various NC, CNC and DNC Machines.
- Explain the working of various tools of CNC machine.
- Understand the operation and working of various system devices used in CNC machines.
- Create various programs of CNC machine. (G&M Code program with post process)
- Troubleshoot various problems occurring CNC machines.
- Understand the concept and working of automation in CNC systems.
- Describe the role of Robot Technology in present market with its basic working.

DETAILED CONTENTS

1. Introduction (12 hrs.)

- 1.1 Introduction to NC, CNC and DNC, their advantages, disadvantages and applications.
- 1.2 Machine Control Unit, input devices, serial communication and Ethernet techniques.
- 1.3 Selection of components to be machined on CNC machines.
- 1.4 Problem with conventional NC.
- 1.5 New Development in NC.
- 1.6 Axis identification.
- 1.7 PLC control and its components.

2. Construction and Tooling (10 Hrs)

- 2.1 Design features, specification of CNC machines.
- 2.2 Use of sideways, balls, rollers and coatings.
- 2.3 Motor and leadscrew, swarf removal, Safety and guarding devices.

- 2.4 Various cutting tools for CNC machines.
- 2.5 Concept of CNC tool holder, different pallet systems and automatic tool changer system.
- 2.6 Management of a tool room.
- 3. System Devices (12 Hrs)
 - 3.1 Control System Open Loop and Closed Loop System.
 - 3.2 Concept of Actuators.
 - 3.3 Transducers and Sensors.
 - 3.4 Tachometer, LVDT, Opto-interrupters.
 - 3.5 Potentiometers for linear and angular position encoder and decoder and axis drives
- 4. Part Programming (16 Hrs)
 - 4.1 Introduction to Part programming.
 - 4.2 Basic concepts of part programming.
 - 4.3 NC words, part programming formats, simple programming for rational components.
 - 4.4 Part programming using canned cycles, subroutines and do loops.
 - 4.5 Tool off sets, cutter radius compensation and tool wear compensation.
- 5. Problems in CNC Machines (06 Hrs)
 - 5.1 Common problems in CNC machines related to mechanical, electrical and pneumatic and Electronic components.
 - 5.2 Study of common problems and remedies.
 - 5.3 Use of on-time fault finding diagnosis tools in CNC machines.
- 6. Automation and NC system (08 Hrs)
 - 6.1 Role of computer in automation.
 - 6.2 Emerging trends in automation, automatic assembly.
 - 6.3 Manufacturing of magnetic tape, Printed circuit boards and Integrated Circuits
 - 6.4 Overview of FMS.
 - 6.5 Group technology.
 - 6.6 CAD/CAM and CIM.

LIST OF PRACTICALS

- 1. Study of constructional detail of CNC lathe.
- 2. Study of constructional detail of CNC milling machine.
- 3. Study the constructional details and working of Automatic tool changer and Multiple pallets

4. Develop a part programme for following lathe operations and make the job on CNC lathe.
 - Plain turning and facing operation.
 - Taper turning operation.
 - Circular interpolation.
5. Develop a part programme for the following milling operation and make the job on CNC milling
 - Plain milling.
 - Slot milling.
 - Contouring.
 - Pocket milling.
6. Preparation of work instructions for machine operator.
7. Preparation of preventive maintenance schedule for CNC machine.
8. Demonstration through industrial visit for awareness of actual working of FMS in production.
9. Use of software for Turning and Milling operation on CNC Turning and Milling Machine Center.

INSTRUCTIONAL STRATEGY

This is highly practice-based course. Efforts should be made to develop programming skills amongst the students. During practice work, it should be ensured that students get opportunity to individually perform practical tasks.

LIST OF RECOMMENDED BOOKS

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. CNC Machines by M.S. Sehrawat and J.S. Narang; Dhanpat Rai and Co., New Delhi.
3. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata Mc Graw Hill, New Delhi.
4. CNC Machine by Bharaj; Satya Publications, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	12	20
2	Unit 2	10	16
3	Unit 3	12	18
4	Unit 4	16	26
5	Unit 5	06	10
6	Unit 6	08	10

5.2 POWER ELECTRONICS

L	P
3	3

RATIONALE

Diploma holders play a vital role in the field of Electronics especially in industry and research organizations 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 re-inforce the knowledge and skill of the students.

LEARNING OUTCOMES

After undergoing this course, students will be able to:

- Understand about the Thyristors and other Electronics devices and differentiate the SCR, DIAC, TRIAC, UJT, MOSFET & its Applications.
- Get knowledge about Controlled Rectifiers - Single phase half controlled wave rectifier & full controlled wave rectifier.
- Enhance their skills in Inverters, Choppers, Dual converters and Cyclo converters - Types and their Applications.
- Aware about the Thyristorised Control of electric drives - DC drive control, AC drive control (Classifications).
- Analyze uninterrupted Power Supply (UPS) - Specifications of on - line, off - line, Smart UPS and Concept of High Voltage DC Transmission.

DETAILED CONTENTS

- | | |
|--|-----------|
| 1. Introduction to thyristors and other Power Electronics Devices | (18 hrs.) |
| 1.1 Construction, Working principle of SCR, two transistor analogy of SCR, V-I characteristics of SCR. | |
| 1.2 SCR specifications and ratings. | |
| 1.3 Different methods of SCR triggering. | |
| 1.4 Different commutation circuits for SCR. | |
| 1.5 Series and parallel operation of SCR. | |
| 1.6 Construction and working principle of DIAC, TRIAC and their V-I characteristics. | |
| 1.7 Construction, working principle of UJT, V-I characteristics of UJT. UJT as relaxation oscillator. | |
| 1.8 Basic idea about the selection of Heat sink for thyristors. | |

- 19 Applications such as light intensity control, speed control of universal motors, fan regulator, battery charger.
2. Controlled Rectifiers (08 hrs.)
 - 21 Single phase half wave controlled rectifier with load (R, R-L)
 - 22 Single phase half controlled full wave rectifier (R, R-L)
 - 23 Fully controlled full wave bridge rectifier.
 - 24 Single phase full wave centre tap rectifier.
3. Inverters, Choppers, Dual Converters and Cyclo converters. (16 hrs.)
 - 31 Principle of operation of basic inverter circuits, concepts of duty cycle, series and parallel Inverters and their applications.
 - 32 Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.
 - 33 Dual Converters and cyclo converters: Introduction, types and basic working principle of dual converters and cyclo converters and their applications.
4. Thyristorised Control of Electric drives (14 hrs.)
 - 41 DC drive control
 - i) Half wave drives
 - ii) Full wave drives
 - iii) Chopper drives (Speed control of DC motor using choppers)
 - 42 AC drive control
 - i) Phase control
 - ii) Constant V/F operation
 - iii) Cyclo converter/Inverter drives.
5. Un interrupted Power Supply (UPS) (08 hrs.)
 - 51 UPS: Block Diagram & specifications of on-line, off line and Smart UPS
 - 52 Concept of high voltage DC transmission
 - 53 Concept of SMPS

LIST OF PRACTICALS

1. To plot V-I characteristic of an SCR.
2. To plot V-I characteristics of TRIAC.
3. To plot V-I characteristics of UJT.
4. To plot V-I characteristics of DIAC.
5. Study of UJT relaxation oscillator. And observe I/P and O/P wave forms
6. Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle.

7. Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
8. Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for Varying lamp intensity and AC fan speed control.
9. Installation of UPS system and routine maintenance of batteries.
10. Speed control of motor using SCR

INSTRUCTIONAL STRATEGY

Power 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.

LIST OF RECOMMENDED BOOKS

1. Power Electronics by P.C. Sen, Tata Mc Graw Hill Education Pvt Ltd. New Delhi.
2. Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi.
3. Power Electronics – Principles and Applications by Vithayathi, Tata Mc Graw Hill Education Pvt Ltd. New Delhi.
4. Power Electronics by Sanjay Puri & Chopra North Publication, Ambala.
5. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.
6. Power Electronics by MH Rashid.
7. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Topic No.	To pic	Time Allotted (Hrs)	Marks Allotted%
1	Unit 1	18	30
2	Unit 2	08	15
3	Unit 3	16	25
4	Unit 4	14	20
5	Unit 5	08	10

5.3 EMPLOYABILITY SKILLS – I

L	P
-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market and survive in cut throat competition among professionals.

LEARNING OUTCOMES

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

- Understand what writing an official and business correspondence involves.
- Develop and practice basic writing skills required for job application and report.
- Explore their values and career choices through individual skill assessments.
- Identify self-management skills essential for work life balance and relate it with examples in daily life activities.
- Assess and improve interpersonal skills required at workplace.
- Learn skills to develop leadership qualities, working in team and resolving conflicts on the work site.
- Develop a sound understanding and knowledge of generic workplace practices and appropriate workplace behavior.

DETAILED CONTENTS

1. Writing skills (08 hrs.)
 - 1.1 Official and business correspondence.
 - 1.2 Job application - covering letter and resume.
 - 1.3 Report writing - key features and kinds.
2. Oral Communication Skills (20 hrs.)
 - 2.1 Giving advice.
 - 2.2 Making comparisons.
 - 2.3 Agreeing and disagreeing.
 - 2.4 Taking turns in conversation.
 - 2.5 Fixing and cancelling appointments.
3. Generic Skills (04 hrs.)
 - 3.1 Stress management.
 - 3.2 Time management.
 - 3.3 Negotiations and conflict resolution.
 - 3.4 Team work and leadership qualities.

5.4 INTERNET OF THINGS

L	P
-	4

RATIONALE

This course focuses on the latest microcontrollers with application development, product design and prototyping. Ideally suited for engineering students with a basic understanding of electronics and microprocessors. The Internet of Things (IOT) is the next wave, world is going to witness. Today we live in an era of connected devices (mobile phones, computers etc.), the future is of connected things (e.g.: home appliances, vehicles, lamp-posts, personal accessories, your pets, industrial equipments and everything which you use in day-to-day life). Internet of Things is a term given to the attempt of connecting objects to the internet and also to each other - allowing people and objects themselves to analyze data from various sources in real-time and take necessary actions in an intelligent fashion.

LEARNING OUTCOMES

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

- Understand the concepts of Internet of Things and needs of IOT in industry.
- Understand the concept of Embedded C programing used for Arduino to design various applications.
- Demonstrate the various led patterns by interfacing LEDs with Arduino UNO board.
- Interface seven segment and 16 × 2 liquid crystal display with Arduino and display the data on LCD.
- Interface various sensors such as IR sensor to detect the object, Ultrasonic sensor to find the distance from the object, DHT11 sensor to detect humidity and temperature, MQ135 sensor to check air quality and they will be able to design various projects.
- Design line follower robot and object detection robot by interfacing DC motor using L293D motor driver module and Servo motor using ULN 2003 motor driving module.
- Design an android based home AC appliances control project by interfacing Bluetooth (HC-05) and Relay module with Arduino.

DETAILED CONTENTS

- | | |
|--|-----------|
| 1. Introduction to Internet of Things (IoT) | (6 hrs.) |
| 1.1 Applications, architecture, protocols | |
| 1.2 Characteristics of IoT | |
| 2. Basics of C language using Arduino IDE | (14 hrs.) |
| 2.1 Understating basics of Arduino IDE | |
| 2.2 Variables, data type, loops, control statement, function | |

3 Practical using Arduino-interfacing sensors

(28 hrs.)

- 3.1 Interfacing Light Emitting Diode(LED)- Blinking LED
- 3.2 Interfacing Button and LED – LED blinking when button is pressed
- 3.3 Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp.
- 3.4 Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)
- 3.5 Interfacing Liquid Crystal Display(LCD) – display data generated by sensor on LCD
- 3.6 Interface Ultrasonic sensor to find the distance from the object
- 3.7 Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value.
- 3.8 Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD
- 3.9 Interfacing Relay module to demonstrate Bluetooth based home automation application. (Using Bluetooth and relay).

INSTRUCTIONAL STRATEGY:

Since this subject is practical oriented, the teacher should demonstrate functioning of various sensors and demonstrate building of IoT applications.

LIST OF RECOMMENDED BOOKS

1. Vijay Madiseti, Arshdeep Bahga, “Internet of Things: A Hands On Approach, University Press
2. Yashavant Kanetkar, Shrirang Korde, “21 Internet Of Things (IOT) Experiments”
3. Neerparaj Rai , “Arduino Projects For Engineers”
4. Chandra S.S.V, “Artificial Intelligence and Machine Learning”

LIST OF COMPONENTS

1. One kit for 3-4 students: Arduino Uno, sensors (Bluetooth module(HC05), MQ135, DHT11, breadboard, LCD, 2-relay module etc.)
2. Consumables: LED, button, connecting wires, LDR, LM35, battery, etc.

5.5 PROCESS CONTROL AND DATA COMMUNICATION

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RATIONALE

For a diploma student, early emphasis on automatic control is vital since a process designed and constructed with proper consideration for its control is the need of modern industry. This course introduces various control mechanisms, modes and devices which are necessary to understand simple control systems in a process plant. The contents of the course have been selected and arranged so as to treat it in a logical manner, to understand the important laws of operation of industrial automatic control systems and to provide a practical background of theory. The course will enable the student to visualize and evaluate the effect of changes in process parameters on the control response. This course also provides the basics of electronic communication systems including transmitters and receivers. In addition to components and systems of analog communication, the students will learn the basics of digital communication.

LEARNING OUTCOMES

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

- Understand about the Basics of Control System, Time varying and Time invariant system and Components/ elements of Closed Loop System.
- Develop skills in Basics of Process Control- PI, PD, PID Examples, Merits and Demerits with response of different control models to step and ramp test inputs.
- Get the knowledge about Control Elements-Solenoid valve, piston operated valve, sizing.
- Aware about the Concept of Basics Communication System-Analog and Digital modulation, Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, UHF, Microwave.

DETAILED CONTENTS

1. Introduction (08 hrs.)
 - 1.1 Basics of control system.
 - 1.2 Time varying and time invariant system.
 - 1.3 Continuous and discrete time control system.
 - 1.4 Open loop and close loop control system.
 - 1.5 Comparison between open loop and closed loop control system.
 - 1.6 Components/elements of closed loop system.
2. Basics of Process Control (12 hrs.)
 - 2.1 Basics of process control and Process variable.

- 2.2 Concept of on-off
 - 2.3 Proportional, Integral, Derivative, PI, PD and PID examples.
 - 2.4 Relative merits and demerits
 - 2.5 Response of different control modes to step and ramp test inputs.
3. Control Elements (06 hrs.)
- 3.1 Principle of operation and constructional details of solenoid valves
 - 3.2 Diaphragm operated valve
 - 3.3 Piston operated valve
 - 3.4 Valve Positioners
 - 3.5 Control valve characteristics and their sizing.
4. Basic Communication System (06 hrs.)
- 4.1 Need and types of modulation systems
 - 4.2 Analog and digital modulation
 - 4.3 Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF, microwave.
5. Analog Modulation Systems (08 hrs.)
- 5.1 Block diagram of AM transmitters and AM receivers.
 - 5.2 DSB, DSB-SC, SSB system.
 - 5.3 FM transmitters and receivers.
 - 5.4 Vestigial side band systems.
6. Data Communication (08 hrs.)
- 6.1 Basic block diagram and principle of working of the following ASK, FSK, PSK, and QPSK.
 - 6.2 Spread Spectrum Techniques, Frequency Hopping Technique.

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.

LIST OF RECOMMENDED BOOKS

1. Control Systems Engineering by I.J. Nagrath and M. Gopal.
2. Linear Control Systems by B.S. Manke; Khanna Publishers.
3. Process Control by Harrist P; McGraw Hill.
4. Process Control Instrumentation Technology by Johnson, Curtis D; John Willey and Sons.
5. Communication Systems by George Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi.
6. Introduction to Data Communication by Blanchard.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Mark Allotted (%)
1	Unit 1	08	16
2	Unit 2	12	24
3	Unit 3	06	14
4	Unit 4	06	14
5	Unit 5	08	16
6	Unit 6	08	16

5.6 MANUFACTURING PROCESSES

L	P
3	9

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes and cutting tools is required to be imparted. Hence the subject of Manufacturing Processes.

LEARNING OUTCOMES

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

- Explain the working principle and concept of milling machine with detailed knowledge of various operations performed on it.
- Explain the working principle and concept of a grinding machine with complete detail of various wheels used on machine.
- Understand the concept of gear manufacturing and working principle and operation of CMM Machines.
- Describe working of boring machine and detail concept of boring operation.
- Understand various modern manufacturing process and techniques like EDM, EBM, LBM and Chronical machining.

DETAILED CONTENTS

1. Cutting Tools and Cutting Materials (04 hrs.)

- 1.1 Cutting Tools - Various types of single point cutting tools and their uses.
- 1.2 Single point cutting tool geometry, tool signature and its effect.

2. Lathe (14 hrs.)

- 2.1 Principle of turning.
- 2.2 Function of various parts of a lathe.
- 2.3 Classification and specification of various types of lathe
- 2.4 Work holding devices
- 2.5 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
- 2.6 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
- 2.7 Speed ratio, preferred numbers of speed selection.

2.8 Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment.

3. Milling (09 hrs.)

- 3.1 Principle of Milling.
- 3.2 Classification of milling machine and application.
- 3.3 Main parts of column and knee type milling machines.
- 3.4 Milling method - Up milling and Down milling.
- 3.5 Milling Operations- face milling, angular milling, form milling, straddle milling and gang milling.
- 3.6 Introduction to indexing.
- 3.7 Universal dividing head.

4. Drilling and Boring (09 hrs.)

- 4.1 Principle of drilling.
- 4.2 Classification of drilling machines and their description.
- 4.3 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
- 4.4 Nomenclature of a twist drill
- 4.5 Principle of boring
- 4.6 Classification of boring machines

5. Shaping, Planning and Slotting (08 hrs.)

- 5.1 Working principle of shaper, planer and slotter.
- 5.2 Type of shaper
- 5.3 Type of planer
- 5.4 Types of tools used and their geometry.
- 5.5 Speeds and feeds in above processes.

6. Cutting Fluids and Lubricants (04 hrs.)

- 6.1 Function of cutting fluid
- 6.2 Types of cutting fluids
- 6.3 Difference between cutting fluid and lubricant
- 6.4 Selection of cutting fluids for different materials and operations
- 6.5 Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

Turning & Grinding Shop

Job 1. Turning & Grinding of single point turning tool.

Job 2. Exercise of simple turning and step turning.

Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

Advance Fitting Shop

Job 1. Exercise on drilling, reaming, counter boring, counter sinking and tapping

Job 2. Dove tail fitting in mild steel

Job 3. Radius fitting in mild steel

Machine Shop

Job 1. Exercise on milling machine to produce a rectangular block.

Job 2. Exercise on milling machine to produce a spur gear.

Job 3. Exercise on Die Sinking EDM and Wire Cut EDM.

INSTRUCTIONAL STRATEGY

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop

LIST OF RECOMMENDED BOOKS

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
4. Workshop Technology by R.C. Jindal; North Publication, Ishan Publishers

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	04	10
2	Unit 2	14	30
3	Unit 3	09	20
4	Unit 4	09	15
5	Unit 5	08	15
6	Unit 6	04	10

STUDENT CENTERED ACTIVITIES

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 District 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.**

SIXTH SEMESTER

6.1 INDUSTRIAL AUTOMATION

L	P
3	3

RATIONALE

A diploma holder employed in automated manufacturing units/assembly lines, process industry, and Power generation stations needs to know about systems/components required for automation of a modern industrial unit. Design concepts have changed to electrical/electronic controls from the conventional mechanical cams/timers, thus making the automation process more flexible and comprehensive.

Programmable logic controllers (PLCs) are flexible automation controllers in which the Inputs/Outputs and Control sequences including timers are changed by changing the programme. Diploma holders in industry are required to trouble shoot/change automation sequences for optimizing the production through automatic machines/assembly lines.

A plant/process Industry/automated manufacturing lines have multiple sensors/actuators /process parameter transmitters which are connected to the central control room through standard instrumentation buses hence knowledge about these buses for data communication will be required. Control methodology are implemented through Supervisory Control and Data Acquisition (SCADA) or Distributor Control (DCs) hence understanding of these is necessary.

LEARNING OUTCOME

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

- Understand the basic and advance concept of Automation and electrical switch gears
- Program advance PLC of different brands
- Understand the basic working of SCADA and graphic designing of SCADA using SCADA software
- Understand Configuration and introduction of DCS
- Communicate using different communication peripherals

DETAILED CONTENTS

1. Automation Components – Relays, Switches, Contactors (Construction, Working & Applications). (08 hrs)
2. Programmable logic controllers (PLCs). (24 hrs)
3. SCADA & DCS. (08 hrs)

- 3.1. Introduction to SCADA,
- 3.2. Different elements of SCADA,
- 3.3. Studying a typical SCADA
- 3.4. Configuration, Meaning of DCS,
- 3.5. Difference between DCS and SCADA,
- 3.6. Comparison of DCS and SCADA

4. Instrumentation Buses (08 hrs.)

- 4.1. Concept of BUS, Sensor Bus, device bus and field bus.
- 4.2. Overview and salient features of Ethernet, HART, Foundation field Bus, ASI Bus, Mod bus, Device-net and Profibus.
- 4.3. Wireless Gateways, Wireless Thum

LIST OF PRACTICALS

1. Identification of control components and using them in simple electrical control circuits.
2. Practicals of PLCs
3. Demonstration of DCS system in typical pharmaceutical plant/thermal power plant

LIST OF RECOMMENDED BOOKS

1. Mechatronics by Bolton
2. Industrial Automation and Robotics by S.K.Arora, Amit Gupta by Laxmi publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted for Lectures and Tutorials (Periods)	Marks Allotted (%)
1	Unit 1	08	16
2	Unit 2	24	50
3	Unit 3	08	18
4	Unit 4	08	16

6.2 ROBOTICS

L	P
3	3

RATIONALE

Robotics and automation are becoming common for various applications in manufacturing plants. Basic knowledge of different configurations, end effectors, sensors and actuators are essential for the diploma students. Diversified applications of robots in industries are enormous and hence students have to be imparted the knowledge of robot applications. Hence this subject

LEARNING OUTCOME:

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

- Understand the basic concept of robot motion and physical configuration
- Learn the basic structure of robotic system & degree of freedom.
- Use of different types of drives, commissioning of drives and application
- Use different types of industrial sensor to make a live project
- Understand the different methods of robot programming, control and application.

DETAILED CONTENTS

1. Introduction (4 hrs.)

Robot definition, need, robot terminology, robot motion, robot classification based on physical configuration, advantages and limitations of robot.

2. Basic Elements of Robots: (20 hrs.)

- 2.1. Basic structure, classification of robotic systems- accordingly to types of system, according to control loop, according to structure of manipulator (Cartesian, cylindrical, spherical and articulated). Degree of freedom.
- 2.2. End effectors- types, working principle and applications Drives- types and application with working principle.
- 2.3. Sensing Devices- optical sensor, proximity sensor- LVDT, Force sensor (strain gauges and piezoelectric), RTD and thermocouple. Motion encoders, Selection Criteria for Robot.

3. Robot controls (8 hrs.) Purpose, level of controls

Device controller

Work cell controller

Servo and Non-servo control systems – types, basic principle and block diagrams.

Working, advantages, limitations of some control system

- Adaptive control
- Computed Torque Technique
- New minimum time control
- Resolved motion control

4. Robot Programming (10 hrs.)

Need and function of robot programming, Methods

- Manual Teaching
- Lead through
- Programming languages (VAN, RAIL)
- Types, features and applications of various programming languages

5. Robotic Applications. (6 hrs.)

Material transfer, Machine loading and unloading, painting, packaging, inspection and welding.

LIST OF PRACTICES

1. Study demonstration and analysis of robot features, specifications, elements, configurations
2. Study on different types of end effectors
3. Study and prepare report for any one type of special purpose robot.
4. Seminar/Group discussion/case study/industrial visit for subject content and recent developments in the field of robotics.
5. Simulation of various robot actions (motions, operations etc.) for different tasks on any robotic software
6. Practice/Programming on robotic software

LIST OF RECOMMENDED BOOKS

1. Robotics for Engineers Yoram Koren; McGraw Hill Publisher
2. CAD/CAM/CIM by P. Radhakrishnan and S. Subramaniam; Wiley Eastern Publishers, New Delhi

3. Robotics by K S Fu, R. C. Gonzalez and C S G Lee
4. Robotic Engineering by Richard K Lafter
5. Robot Reliability and Safety by B.S.Dhillon
6. Industrial Robotics by M.P.Groovers et al.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted for Lectures and Tutorials (Periods)	Marks Allotted (%)
1	Unit 1	04	10
2	Unit 2	20	30
3	Unit 3	08	15
4	Unit 4	10	25
5	Unit 5	06	20

6.3 INSPECTION AND QUALITY CONTROL

L	P
4	2

RATIONALE

Diploma holders in this course required to measure and inspect for ensuring quality of product. For this purpose, knowledge and skills about standards of measurement, limits, fits and tolerances, types of inspection and various measuring instruments, SQC & quality standards are necessary. Hence this subject.

LEARNING OUTCOME:

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

- Describe and explain various metrological terms like line standards, end standards, calibration, Fits and Tolerance
- Explain and demonstrate instruments like Slip gauges, Micrometer, Vernier Caliper
- Explain and demonstrate various gauges like NPL gauge
- Understand, define, explain and review Taylor's principles of gauge design
- Predict and examine various modes and types of errors and also the demonstration of devices used for measurement.
- Evaluate and do analysis of parameters of screw threads
- Determine and describe various methods of measurements of gear terminology

DETAILED CONTENT

1. Inspection (09 hrs.)
 - 1.1. Introduction, units of measurement, standards for measurement and interchangeability.
 - 1.2. International, national and company standard, line and wavelength standards.
 - 1.3. Planning of inspection: what to inspect? When to inspect? Who should inspect? Where to inspect?
 - 1.4. Types of inspection: remedial, preventive and operative inspection, incoming, in-process and final inspection.

- 1.5. Study of factors influencing the quality of manufacture.
2. Measurement and Gauging (22 hrs.)
 - 2.1. Basic principles used in measurement and gauging, mechanical, optical, electrical and electronic.
 - 2.2. Study of various measuring instruments like: calipers, micrometers, dial indicators, surface plate, straight edge, try square, protectors, sine bar, clinometer, comparators – mechanical, electrical and pneumatic. Slip gauges, tool room microscope, profile projector.
 - 2.3. Limit gauges: plug, ring, snap, taper, thread, height, depth, form, feeler, wire and their applications for linear, angular, surface, thread and gear measurements, gauge tolerances.
 - 2.4. Geometrical parameters and errors:
 - 2.5. Errors & their effect on quality, concept of errors, measurement of geometrical parameter such as straightness, flatness and parallelism.
 - 2.6. Study of procedure for alignment tests on lathes, drilling and milling machines.
 - 2.7. Testing and maintenance of measuring instruments.
3. Statistical Quality Control (16 hrs.)
 - 3.1. Basic statistical concepts, empirical distribution and histograms, frequency, mean, mode, standard deviation, normal distribution, binomial and Poisson, Simple-examples.
 - 3.2. Introduction to control charts, namely X, R, P and C charts and their applications.
 - 3.3. Sampling plans, selection of sample size, method of taking samples, frequency of samples.
 - 3.4. Inspection plan format and test reports
4. Modern Quality Concepts (09 hrs.)
 - 4.1. Concept of total quality management (TQM)
 - 4.2. National and International Codes.
 - 4.3. ISO-9000, concept and its evolution
 - 4.4. QC tools
 - 4.5. Introduction to Kaizen, 5S
5. Instrumentation (08 hrs.)

Measurement of mechanical quantities such as displacement, vibration, frequency, pressure temperature by electro mechanical transducers of resistance, capacitance & inductance type.

LIST OF PRACTICALS

- 1 Use of dial indicator for measuring taper.
- 2 Use of combination set, bevel protector and sine bar for measuring taper.
- 3 Measurement of thread characteristic using vernier and gauges.
- 4 Use of slip gauge in measurement of center distance between two pins.
- 5 Use of tool maker's microscope and comparator.
- 6 Plot frequency distribution for 50 turned components.
- 7 With the help of given data, plot X, R, P and C charts

LIST OF RECOMMENDED BOOKS

1. Statistical Quality Control by M. Mahajan: Dhanpat Rai and Sons, Delhi
2. Engineering Metrology by RK Jain
3. Engineering Metrology by RK Rajput; SK Kataria and Sons
4. Production Planning Control and Management by KC Jain & Aggarwal; Khanna Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	09	14
2	Unit 2	22	34
3	Unit 3	16	24
4	Unit 4	09	14
5	Unit 5	08	14

6.4 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L	P
3	-

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOME:

- Understand basic idea of entrepreneurship along with the assistance schemes by entrepreneurial support agencies.
- Analyse the business environment in order to identify opportunities and obtaining information about their customers.
- Write detailed project reports including technical, economics and marketing feasibilities along with an understanding of common errors.
- Understand the function and principle of Management along with the concept and structure of the organization.
- Discuss vastly leadership and motivation, and can able to differentiate between manager and leader.
- Understand the scope of management in different areas like HRM, Material & store management, Marketing & sales and Financial Management.
- Describe and understand the need for Customer Relation Management (CRM). Explain the meaning of Total Quality Management (TQM), Statistical process control, Total employees Involvement & Just in Time.
- Define the importance and understanding of Intellectual Property Rights (IRC).

DETAILED CONTENTS

SECTION – A ENTREPRENEURSHIP

1. Introduction (14 hrs.)

- 1.1. Concept /Meaning and its need
- 1.2. Qualities and functions of entrepreneur and barriers in entrepreneurship
- 1.3. Sole proprietorship and partnership forms of business organisations
- 1.4. Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

2. Market Survey and Opportunity Identification (10 hrs.)

- 2.1. Scanning of business environment
- 2.2. Salient features of National and State industrial policies and resultant business opportunities
- 2.3. Types and conduct of market survey
- 2.4. Assessment of demand and supply in potential areas of growth
- 2.5. Identifying business opportunity
- 2.6. Considerations in product selection

3. Project report Preparation (08 hrs.)

- 3.1. Preliminary project report
- 3.2. Detailed project report including technical, economic and market feasibility
- 3.3. Common errors in project report preparations
- 3.4. Exercises on preparation of project report

SECTION –B MANAGEMENT

4. Introduction to Management (04 hrs.)

- 4.1. Definitions and importance of management
- 4.2. Functions of management: Importance and Process of planning, organising, staffing, directing and controlling
- 4.3. Principles of management (Henri Fayol, F.W. Taylor)
- 4.4. Concept and structure of an organisation

- 4.5. Types of industrial organisations
 - 4.5.1 Line organisation
 - 4.5.2 Line and staff organisation
 - 4.5.3 Functional Organisation

5. Leadership and Motivation (03 hrs.)

- 5.1. Leadership
 - 5.1.1. Definition and Need
 - 5.1.2. Qualities and functions of a leader
 - 5.1.3. Manager Vs. leader
 - 5.1.4. Types of leadership
- 5.2. Motivation
 - 5.2.1. Definitions and characteristics
 - 5.2.2. Factors affecting motivation
 - 5.2.3. Theories of motivation (Maslow, Herzberg, McGregor)

6. Management Scope in Different Areas (06 hrs.)

- a) Human Resource Management
 - Introduction and objective
 - Introduction to Man power planning, recruitment and selection
 - Introduction to performance appraisal methods
- b) Material and Store Management
 - Introduction functions, and objectives
 - ABC Analysis and EOQ
- c) Marketing and sales
 - Introduction, importance, and its functions
 - Physical distribution
 - Introduction to promotion mix
 - Sales promotion
- c) Financial Management
 - Introductions, importance and its functions
 - Elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT

7. Miscellaneous Topics (03 hrs.)

- a) Customer Relation Management (CRM)
 - Definition and need

- Types of CRM
- b) Total Quality Management (TQM)
 - Statistical process control
 - Total employees Involvement
 - Just in time (JIT)
- c) Intellectual Property Right (IPR)
 - Introductions, definition and its importance
 - Infringement related to patents, copy right, trade mark

Note: In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised.

INSTRUCTIONAL STRATEGY

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

LIST OF RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd., New Delhi
3. Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, New Delhi
4. Entrepreneurship Development - Small Business Enterprises by Poornima M Charantimath; Pearson Education, New Delhi
5. Entrepreneurship : New Venture Creation by David H Holt; Prentice Hall of India Pvt. Ltd., New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Principles and Practice of Management by L M Prasad; Sultan Chand & Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Tpoics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	14	28
2	Unit 2	10	20
3	Unit 3	08	16
4	Unit 4	04	10
5	Unit 5	03	06
6	Unit 6	06	14
7	Unit 7	03	06

6.5 EMPLOYABILITY SKILLS – II

L P
- 2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject to prepare students for employability in job market and survive in cut throat competition among professionals.

LEARNING OUTCOMES

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

- Identify appropriate verbal and non- verbal communication skills for an interview (e.g. eye contact, use of filler words, hand gestures, and verbal place).
- Demonstrate professional behaviour including preparedness, professional attire, and respectful presentation.
- Develop confidence in relationship to their interviewing, meeting, seminar and presentation skills.
- Consider ways of grabbing the listener's attention, holding their interest and concluding strongly.
- Enhance their presentation with use of body language, voice tone, slides and visual aids.
- Deliver an enthusiastic and well – practiced presentation.

DETAILED CONTENTS

1. Oral Practice

S.No.	Description	Time/Duration
i)	Mock interview	(05 hrs.)
ii)	Preparing for meeting	(05 hrs.)
iii)	Group discussion	(05 hrs.)
iv)	Seminar presentation	(05 hrs.)
v)	Making a presentation	(12 hrs.)
	a) Elements of good presentation	
	b) Structure and tools of presentation	
	c) Paper reading	
	d) Power point presentation	

6.6 MECHANISMS AND MACHINES

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RATIONALE

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

LEARNING OUTCOMES

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

- Describe the principle and basic concept of machines and their working mechanism.
- Understand the type working of various power transmission methods used in machines.
- Understand the use and working of flywheel.
- Describe the use and working of cam and its system.
- Understand various concepts and techniques of balancing.
- Explain the concept and type of vibrations in the machines

DETAILED CONTENTS

1. Basic Concepts (12 hrs.)
 - 1.1 Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversion.
 - 1.2 Four bar chains and its inversions, Single slider crank chain and its inversions, Double slider crank chain and its inversions
2. Power Transmission (12 hrs.)
 - 2.1 Introduction to belt and rope drives
 - 2.2 Types of belt drives and types of pulleys
 - 2.3 Concept of velocity ratio, slip and creep; crowning of pulleys (simple numerical)
 - 2.4 Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numerical)

- 2.5 Different types of chains and their terminology
- 2.6 Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear
- 3. Flywheel (08 hrs.)
 - 3.1 Principle and applications of flywheel, Types of fly wheel
 - 3.2 Turning - moment diagram of flywheel for different engines
 - 3.3 Fluctuation of speed and fluctuation of energy - Concept only
 - 3.4 Coefficient of fluctuation of speed and coefficient of fluctuation of energy
 - 3.5 Simple numerical problems on fluctuation of speed and fluctuation of energy
- 4. Cam (06 hrs.)
 - 4.1 Function of Cam
 - 4.2 Types of cams and followers, Displacement diagram
 - 4.3 Simple cam profile for uniform velocity, SHM and uniform acceleration and retardation with flat, knife edge and roller type follower
- 5. Balancing (08 hrs.)
 - 5.1 Concept of balancing
 - 5.2 Introduction to balancing of rotating masses (simple numerical)
 - 5.3 Concept of reference plane
 - 5.4 Simple problems related to several masses rotating in different planes
- 6. Vibrations (02 hrs.)
 - 6.1 Concept of vibrations and its types - longitudinal, transverse and torsional vibrations
 - 6.2 Damping of vibrations
 - 6.3 Causes of vibrations in machines, their harmful effects and remedies

INSTRUCTIONAL STRATEGY

- 1. Use teaching aids for classroom teaching
- 2. Give assignments for solving numerical problems
- 3. Arrange industry visits to augment explaining use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
- 4. Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

LIST OF RECOMMENDED BOOKS

1. Theory of Machines by D.R. Malhotra; Satya Prakashan, New Delhi.
2. Theory of Machines by S.S Rattan TataMcGraw hill New Delhi.
3. Theory of Machines by Jagdish Lal; Metropolitan Publishers, New Delhi.
4. Theory of Machines by R.C. Jindal; North Publications.
5. Theory of machines by R.S Khurmi; S Chand and Company Ltd. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Topics	Time Allotted (Hrs)	Marks Allotted (%)
1	Unit 1	12	22
2	Unit 2	12	22
3	Unit 3	08	18
4	Unit 4	06	14
5	Unit 5	8	14
6	Unit 6	02	10

6.7 PROJECT WORK

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Project work aims at developing skills in the students whereby they apply in totality the knowledge and skills gained through the course in the solution of a practical problem undertaken as a project work. The students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or be given project assignment at least two to three months in advance. The project work identified in collaboration with industry/field organization should be preferred.

Each teacher is expected to guide the project work of 5-6 students at a time. Report for all the four project should be prepared and will give a seminar. The same will be assessed for internal and external assessment. Some of the projects are listed as follows:

1. Fabrication of:
 - 1.1 Voltage Stabilizer for refrigerator, air-conditioner.
 - 1.2 Emergency light using SCR.
 - 1.3 Power amplifier.
 - 1.4 Low cost intercom for home.
 - 1.5 Analog computer.
 - 1.6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906.
 - 1.7 Automatic battery charger using SCR.
 - 1.8 Digital Clock.
 - 1.9 FM Radio Receiver.
 - 1.10 Burglar Alarm.
 - 1.11 Fabrication of UPS.
 - 1.12 Automatic street light/dressing table light.
 - 1.13 Mosquito Repellent.
 - 1.14 Inverter circuit 500 watt/1 KVA.
 - 1.15 Solid State Control of Traffic Light.

2 **Fabrication and Testing of:**

- 2.1. Inverter/Emergency light circuit using power transistors.
 - 2.2. SCR based automatic battery charger.
 - 2.3. SCR operated illumination controller.
 - 2.4. SCR operated automatic water level controller.
 - 2.5. SCR based speed controller for DC shunt motor.
 - 2.6. Three-phase full wave rectifier using power diodes.
 - 2.7. Timer circuit using 555-IC.
 - 2.8. SCR controlled rectifier circuit.
 - 2.9. Speed control circuit of DC shunt motor using SCR.
 - 2.10. Inverting and non-inverting amplifiers using OP-AMP (741).
 - 2.11. Comparator circuits using OP-AMP (741).
3. Project using PLC.
 4. Project relating to Microprocessor.
 5. Project relating to Microcontroller.

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

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

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

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get “Overall Good grade” failing which

the students may be given one more chance to improve and re-evaluated before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

S.No.	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 < > 65	Very good
iii)	64 < > 50	Good
iv)	49 < > 40	Fair
v)	Less than 40	Poor

Important Notes

1. The internal and external examiner must follow these criteria 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, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the student’s performance as per the above criteria.
4. It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work. The students must submit project report. It is proposed that the institute may organize an annual exhibition of the project items prepared by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.

STUDENT CENTERED ACTIVITIES

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 District 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.**