Curriculum for

DIPLOMA COURSE

IN PLASTIC MOULD TECHNOLOGY

For the State of Uttar Pradesh

Prepared by:

IRDT, Kanpur

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PREFACE

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

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

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

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

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1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN PLASTIC MOULD TECHNOLOGY

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

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

9) Ecology and Environment:

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

10) Energy Conservation:

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

11) Entrepreneurship Development:

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

12) Student Centred Activities:

A provision of 2-5 periods per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co–curricular activities such as expert lectures, self-study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

13) Project work

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

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN PLASTIC MOULD TECHNOLOGY

The following are the major employment opportunities for diploma holders in Plastic Mould Technology:

- In manufacturing industry primarily in private sector and to some extent in public sector
- In service sector like Railways, Hospitals, Military Engineering Services, Boards and Corporations, Construction 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 Plastic Mould Technology find placement in all functional areas like R&D, planning, shop floor production, quality control, inventory management but majority of them find employment in shop floor management.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN PLASTIC MOULD TECHNOLOGY

After undergoing this programme, students will be able to:

1.	Prepare and interpret drawings of plastic components.
2.	Use software like AutoCAD and Solid Works to prepare and analyse of different types of moulds for plastic products
3.	Prepare simple jobs as per specifications.
4.	Carry out casting and welding operation.
5.	Use modern machining methods for machining of components.
6.	Carry out metal forming by rolling and forging processes to produce parts.
7.	Use surface coating and protection methods.
8.	Use hydraulic and pneumatic equipment.
9.	Use electrical and electronic instruments to measure various engineering parameters.
10.	Use various measuring and gauging instruments.
11.	Design and modify simple mould elements.
12.	Select material as per desired application.
13.	Select and use QC tools for mould design
14.	Carry out work measurement and method study to improve productivity.
15.	Use appropriate practices for conservation and prevention of environment pollution.
16.	Interpret factory acts and laws.
17.	Communicate effectively in English in oral and written form with others.
18.	Manage resources effectively at workplace.
19.	Plan and execute given task/project as a team member or leader.
20.	Prepare detailed project proposal and report.
21.	Use computer and IT tools for creating document, making spread sheet and making presentation.
22.	Solve real life problems by application of acquired knowledge and skills.
23.	Handle the customers effectively.
24.	Apply concepts of Mechanics to solve engineering problems.
25.	Apply basic principles of Mathematics and Science to solve engineering problems.
26.	Apply inventory control techniques to reduce production cost.
27.	Interpret basic hydraulic and thermodynamics processes / cycles.
28.	Manage activities related to procurement, stacking, storage and preservation of materials.

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas/subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Prepare and interpret drawings of engineering components.	– Engineering Drawing
2.	Use software like AutoCAD and Solid Works to prepare and analyse solid models.	– Computer aided Mould design
3.	Prepare simple jobs as per specifications.	– General Workshop Practice
4.	Operate conventional machine for machining of components as per specifications	– General workshop practice
5.	Use cutting tools for machines and machine tools.	– General Workshop Practice
6.	Carry out casting and welding operation.	– General workshop practice
7.	Use machining methods for machining of components.	– General workshop practice
8.	Carry out metal forming by rolling and forging processes to produce parts.	– General workshop practice
9.	Understand various types of metals, nonmetals, testing of metals and alloys.	– Materials and metallurgy
10.	Identify the plastics, characteristics of materials, mechanical and thermal properties of materials.	- Plastic testing lab
11.	Concept of mould design, types of dies and mould materials and knowledge of different parts of moulds.	– Design of dies and moulds
12.	Use hydraulic and pneumatic equipment.	– Hydraulics and Pneumatics systems
13.	Gain knowledge of rotational moulding process, compression moulding,transfer moulding. Understand pultrusion and hand lay-up techniques.	– Plastic processesing techniques
14.	Use various measuring and gauging instruments.	– Metrology and Measuring Instruments
15.	Takes the form of dialogue between teachers and the students to begin with and then to continue within the student leading.	– Universal human values
16.	Design and modify simple mould elements.	– Computer aided Mould design lab
17.	Select and use QC tools for mould design	– Metrology and Measuring Instruments
18.	Use appropriate practices for conservation of energy and prevention of environment pollution.	– Environmental Studies – Energy Conservation

19.	Interpret factory acts and laws.	– Industrial Management and Entrepreneurship Development
20.	Communicate effectively in English in oral and written form with others.	– Communication Skills – Student Centred Activities (SCA)
21.	Manage resources effectively at workplace.	– Industrial Management and Entrepreneurship Development
22.	Plan and execute given task/project as a team member or leader.	– Industrial Engineering and Safety
23.	Prepare detailed project proposal and report.	– Project Work
24.	Use computer and IT tools for creating document, making spread sheet and making presentation.	– Basics of Information Technology
25.	Solve real life problems by application of acquired knowledge and skills.	– Project Work
26.	Handle the customers effectively.	– Industrial Management and Entrepreneurship Development
27.	Apply concepts of Mechanics to solve engineering problems.	– Applied Mechanics
28.	Apply basic principles of Mathematics and Science to solve engineering problems.	– Applied Mathematics – Applied Physics – Applied Chemistry
29.	Interpret basic hydraulic and pneumatic systems	– Hydraulics and Pneumatics systems

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

1. Communication Skills
2. Environmental Studies
3. Energy Conservation
4. Universal Human Values

b) Applied Sciences

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

c) Basic Courses in Engineering/Technology

8. Engineering Drawing-I
9. General Workshop Practice -I
10. Fundamentals of Polymers
11. Basics of Information Technology
12. Elementary Workshop Technology
13. General Workshop Practice -II

d) Applied Courses in Engineering/Technology

14. Plastic Materials-I
15. Materials & Metallurgy
16. Plastic Testing-I
17. Mould Manufacturing
18. Plastic processing Techniques -I
19. Hydraulics and Pneumatics systems
20. Plastic Materials-II
21. Industrial Management and Entrepreneurship Development
22. Design of Dies & Moulds-I
23. Plastic Processing Techniques-II
24. Design of Dies & Mould-II
25. Plastic Testing-II
26. Plastic Recycling & Waste Management
27. Metrology and Measuring Instruments
28. Computer Aided Mould Design Lab

e) Industrial Training

29. Project Work

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	Communication Skills	6	-	-	6	-	-
2.	Applied Mathematics	5	5	5	-	-	-
3.	Applied Physics	7	7	-	-	-	-
4.	Applied Chemistry	7	-	-	-	-	-
5.	Engineering Drawing-I	8	-	-	-	-	-
6.	Basics of Information Technology	6	-	-	-		
7.	General Workshop Practice	8	8	-	-	-	-
8.	Applied Mechanics	-	7	-	-	-	-
9.	Fundamentals of Polymers	-	6	-	-	-	-
10.	Elementary Workshop Technology	-	5	-	-	-	-
11.	Plastic Materials-I	-	-	6	-	-	-
12.	Materials & Metallurgy	-	-	10	-	-	-
13.	Plastic Testing-I	-	-	10	-	-	-
14.	Mould Manufacturing	-	-	6	-	-	-
15.	Plastic processing Techniques -I	-	-	9	-	-	-
16.	Hydraulics & Pneumatic Systems	-	-	-	8	-	-
17.	Plastic Materials-II	-	-	-	5	-	-
18.	Design of Dies & Moulds-I	-	-	-	9	-	-
19.	Environmental Studies	-	-	-	5	-	-
20.	Energy Conservation	-	-	-	5	-	-
21.	Industrial Management and Entrepreneurship Development	-	-	-	-	5	-
22.	Plastic Processing Techniques-II	-	-	-	-	14	-
23.	Design of Dies & Mould-II	-	-	-	-	14	-
24.	Plastic Testing-II	-	-	-	-	8	-
25.	Universal Human Values	-	-	-	-	3	-
26.	Plastic Recycling & Waste Management	-	-	-	-	-	6
27.	Metrology and Measuring Instruments	-	-	-	-	-	11
28.	Computer Aided Mould Design Lab	-	-	-	-	-	14
29.	Project Work	-	-	-	-	-	12
30.	Student Centred Activities (SCA)	1	5	2	3	3	2
Total		**48**	**43**	**48**	**41**	**47**	**45**

7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN PLASTIC MOULD TECHNOLOGY

FIRST SEMESTER

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

* Common with other diploma programmes

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

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics - II	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
2.2	*Applied Physics -II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.3	+Applied Mechanics	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.4	Fundamentals of Polymers	6	-	-	5	30	-	30	70	2 ½	-	-	70	100
2.5	Elementary Workshop Technology	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100
#Student Centred Activities (SCA)		-	-	5	1	-	30	30	-	-	-	-	-	30
Total		**26**	**-**	**17**	**26**	**110**	**90**	**200**	**270**	**-**	**100**	**-**	**370**	**570**

* Common with other diploma programmes

\+ Common with diploma in Chemical Engg. and Civil Engg.

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

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
3.2	Plastic Materials-I	6	-	-	5	30	-	30	70	2 ½	-	-	70	100
3.3	Materials & Metallurgy	4	2	4	6	20	10	30	50	2 ½	20	3	70	100
3.4	Plastic Testing-I	6	-	4	6	20	10	30	50	2 ½	20	3	70	100
3.5	Mould Manufacturing	4	2	-	5	30	-	30	70	2 ½	-	-	70	100
3.6	Plastic processing Techniques -I	5	-	4	5	20	10	30	50	2 ½	20	3	70	100
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**30**	**04**	**14**	**32**	**140**	**60**	**200**	**340**	**-**	**60**	**-**	**400**	**600**

* Common with other diploma programmes

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

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skill-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	+Hydraulics & Pneumatic Systems	5	1	2	6	20	10	30	50	2 ½	20	3	70	100
4.3	Plastic Materials-II	5	-	-	4	20	-	20	50	2 ½	-	-	70	70
4.4	Design of Dies & Moulds-I	4	1	4	6	20	10	30	50	2 ½	20	3	70	100
4.5	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**24**	**02**	**15**	**27**	**120**	**80**	**200**	**300**	**-**	**100**	**-**	**400**	**600**

* Common with other diploma programmes

\+ Common with diploma Mech. Engg.

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

Note: ** Four Weeks of Industrial Training to be assessed in Fifth Semester. ** Student will be required to complete four weeks industrial training after the completion of 4th semester.

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
	Industrial Training (4 Weeks)	-	-	-		-	-	-	-	-	50	-	50	50
5.1	*Industrial Management and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
5.2	Plastic Processing Techniques-II	5	2	7	6	20	10	30	50	2 ½	20	3	70	100
5.3	Design of Dies & Mould-II	5	2	7	6	20	10	30	50	2 ½	20	3	70	100
5.4	Plastic Testing-II	4	-	4	5	20	10	30	50	2 ½	20	3	70	100
5.5	*Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**21**	**04**	**22**	**23**	**80**	**80**	**160**	**200**	**-**	**140**	**-**	**340**	**500**

* Common with other Engg. Diploma programmes

\+ Common with diploma Mech. Engg.

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

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Plastic Recycling & Waste Management	6	-	-	5	30	-	30	70	2 ½	-	-	70	100
6.2	+ Metrology and Measuring Instruments	7	-	4	7	20	10	30	50	2 ½	20	3	70	100
6.3	Computer Aided Mould Design Lab	-	-	14	6	-	20	20	-	-	50	3	70	70
6.4	Project Work	-	-	12	4	-	40	40	-	-	60	3	60	100
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**13**	**-**	**32**	**23**	**50**	**100**	**150**	**120**	**-**	**120**	**-**	**250**	**400**

\+ Common with diploma Mech. Engg.

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

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

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

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

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

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

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

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

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

1.1 COMMUNICATION SKILLS – I

L	T	P
4	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

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DETAILED CONTENTS

1 Basics of Communication (13 periods)

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

2 Application of Grammar (18 periods)

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

3 Reading Skill (10 periods)

Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

4 Writing Skill (15 periods)

4.1 Picture composition
4.2 Writing paragraph
4.3 Notice writing

LIST OF PRACTICALS

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

Listening and Speaking Exercises

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria & Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

Websites for Reference:

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

SUGGESTED DISTRIBUTION OF MARKS

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

1.2 APPLIED MATHEMATICS - I

L	T	P
5	-	-

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Algebra -I (12 Periods)

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

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

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

2. Algebra- II (12 Periods)

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

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

3. Trigonometry (10 Periods)

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

   3.2 Inverse circular functions : Simple case only

4. Differential Calculus - I (18 Periods)

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

4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.

5. Differential Calculus - II (18 Periods)

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

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

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

1.3 APPLIED PHYSICS – I

L	T	P
5	-	2

RATIONALE

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

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Units and Dimensions (10 Periods)

1.1 Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
1.2 Dimensions and dimensional formulae of physical quantities.
1.3 Principle of homogeneity of dimensions
1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
1.5 Limitations of dimensional analysis
1.6 Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.
1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non-metallic blocks, wires, pipes etc (at least two each).

2. Force and Motion (10 periods)

2.1 Scalar and vector quantities – examples, representation of vector, types of 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 (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
2.8 Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.
2.9 Application of various forces in lifts, cranes, large steam engines and turbines

3. Work, Power and Energy (10 periods)

3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,

3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.

3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.

3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

3.6 Power and its units, calculation of power in numerical problems

3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

4 Rotational Motion (10 periods)

4.1 Concept of translatory and rotatory motions with examples

4.2 Definition of torque with examples

4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples

4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.

4.5 Rotational kinetic energy, Rolling of sphere on the slant plane,

4.6 Comparison of linear motion and rotational motion.

4.7 Application of rotational motions in transport vehicles, and machines.

5 Motion of planets and satellites (08 periods)

5.1 Gravitational force, Kepler's law of planetary motion,

5.2 Acceleration due gravity and its variation,

5.3 Gravitational Potential and Gravitational potential energy,

5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity,

5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology,

5.6 Concept of Black Holes

6. Properties of Matter (12 periods)

6.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve

6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications

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

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

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

7. Heat and Thermodynamics (10 periods)

7.1 Difference between heat and temperature

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

7.3 Different scales of temperature and their relationship

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

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

7.6 Isothermal and Adibatic process

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

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

LIST OF PRACTICALS (to perform minimum six experiments)

1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.
2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.
3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
4 To verify parallelogram law of forces
5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.
6 To find the Moment of Inertia of a flywheel about its axis of rotation
7 To determine the atmospheric pressure at a place using Fortin's Barometer
8 To determine the viscosity of glycerine by Stoke's method
9 To determine the coefficient of linear expansion of a metal rod
10 To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

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

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

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

TOPIC WISE DISTRIBUTION OF PERIODS AND MARKS

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

1.4 APPLIED CHEMISTRY

L	T	P
5	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

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

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

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

1.3 Atomic number, atomic mass number isotopes and isobars.

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

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

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

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

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

2. Fuels and Lubricants (18 periods)

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

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

2.3 Coal - types of coal and proximate analysis of coal

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

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

2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.

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

2.8 Synthetic lubricants and cutting fluids.

3. Water (14 periods)

3.1 Demonstration of water resources on Earth using pie chart.

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

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

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

3.5 Physico-Chemical methods for Water Quality Testing

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

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

c) Understanding of Indian Water Quality standards as per WHO

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

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

4. Electrochemistry (4 periods)

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

5. Corrosion and its Control (10 periods)

5.1 Definition of corrosion and factors affecting corrosion rate.

5.2 Theories of

a) Dry (chemical) corrosion- Pilling Bedworth rule

b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism

5.3 Definition of passivity and galvanic series

5.4 Corrosion control:

a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel – Application of Metal Zn (Sheradizing),Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage

b) Inorganic coatings – Anodizing and phosphating,

c) Organic coatings - use of paints varnishes and enamels

d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

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

6.1 Classification of organic compounds and IUPAC Nomenclature

6.2 Definition of polymer, monomer and degree of polymerization

6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)

6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics

6.5 Applications of polymers in industry and daily life

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

- **MEANS OF ASSESSMENT**
- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva-Voce

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

1.5 ENGINEERING DRAWING - I

L	T	P
-	-	8

RATIONALE

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

Note:

i) First angle projection is to be followed

ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD

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

LEARNING OUTCOMES

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

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

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 (1^{st} and 3^{rd} angle)
      4.3.1. Line parallel to both the planes
      4.3.2. Line perpendicular to any one of the reference plane
      4.3.3. Line inclined to any one of the reference plane.
   4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1^{st} angle only
   4.5 Three views of orthographic projection of different objects. (At least one sheet in 3^{rd} angle)
   4.6 Identification of surfaces

5 Projection of Solid (02 sheets)

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

6. Sections (02 sheets)

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

7. Isometric Views (02 sheets)

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

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

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

*9. Introduction to AutoCAD (02 sheets)

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

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

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 BASICS OF INFORMATION TECHNOLOGY

L	T	P
	-	-6

RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all 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 the subject, the students will be able to:

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

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Introduction to Computers and Peripherals.

   Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD,Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.
2. Operation System and Application Software

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

3. Word Processing, Spreadsheet and Presentation

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

.

4. Internet

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

LIST OF PRACTICAL EXERCISES

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

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

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

e) Tables and Borders:
   - Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, 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 envelops and lables
- Using shapes and drawing toolbar,
- Working with more than one window .

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

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

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

c) Work books:
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations
Editing a worksheet, copying, moving cells, pasting, inserting, 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.

11. PowerPoint Presentation (MS Office/Open Office/Libre 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 sorter.

b) Addition, deletion and saving of slides

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

d) Formatting slides
- Using slide master
- Text formatting

- Changing slide layout
- Changing slide colour scheme
- Changing background
- Applying design template

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon 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

Online Resources

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

1.7 GENERAL WORKSHOP PRACTICE – I

(Common with Mechanical Engineering)

L	T	P
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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 OUTCOMES

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

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

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the 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. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop
4. Smithy Shop
5. Plumbing Shop

1. CARPENTRY SHOP

1.1 General Shop Talk

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

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

1.1.3 Specification of tools used in carpentry shop.

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

1.1.5 Seasoning of wood.

1.2. Practice

1.2.1 Practices for Basic Carpentry Work

1.2.2 Sawing practice using different types of saws

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

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

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

1.3 Job Practice

Job 1 Marking, sawing, planning and chiselling and their practice

Job II Half Lap Joint (cross, L or T – any one)

Job III Mortise and Tenon joint (T-Joint)

Job IV Dove tail Joint (Lap or Bridle Joint)

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

2. PAINTING AND POLISHING SHOP

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

2.2. Job Practice

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

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

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

The sequence of polishing will be as follows:

i) Abrasive cutting by leather wheel

ii) Polishing with hard cotton wheel and with polishing material

iii) Buffing with cotton wheel or buff wheel.

3. ELECTRICAL SHOP

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

3.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to 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.

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

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

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

3.5 Introduction to battery charger and its functioning.

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

4. SMITHY SHOP

4.1. General Shop Talk

4.1.1 Purpose of Smithy shop

4.1.2 Different types of Hearths used in Smithy shop

4.1.3 Purpose, specifications, uses, care and maintenance of various tools and equipments used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.

4.1.4 Types of fuel used and maximum temperature obtained

4.1.5 Types of raw materials used in Smithy shop

4.1.6 Uses of Fire Bricks & Clays in Forging workshop.

4.2 Practice

4.2.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

4.2.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting

a) Demonstration — Making cube, hexagonal cube, hexagonal bar from round bar

4.2.3 Practice of Simple Heat treatment processes like Tempering, Normalizing Hardening etc

4.3. Job Practice: Job Preparation

Job I	Making a cold / hot, hexagonal / octagonal flat chisel including tempering of edges.
Job II	Production of utility goods e.g. hexagonal bolt / square shank boring tool, fan hook (long S-type) [Two jobs are to be done by the students].
Job III	To prepare a cube from a M.S. round by forging method.

5. PLUMBING SHOP

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

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

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

5.4. Job Practice

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

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

Job III: Threading practice on pipe with die

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

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

2.1 APPLIED MATHEMATICS - II

L	T	P
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RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Integral Calculus - I (20 Periods)

Methods of Indefinite Integration :-

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

2. Integral Calculus - II: (20 Periods)

2.1 Meaning and properties of definite integrals, Evaluation of definite integrals..
2.2 Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.
2.3 Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

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

3.1 Circle

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

Two intercept form.

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

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

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.
Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

After undergoing this 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.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and itsmeasurement.
- List the effects of an electric current and their 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
- Explain Biot-Savart Law, Ampere's law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor
- Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

DETAILED CONTENTS

1. Wave motion and its applications (12 periods)
   - 1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length 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 and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., simple pendulum, concept of simple harmonic progressive wave,

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

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

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

2. Wave Optics (6 periods)

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

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

2.3 use of interference making highly efficient solar panel.

2.4 diffraction, Single Slit diffraction, Intensity calculation etc

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

3. Electrostatics (12 periods)

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

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

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

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

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

4. Current Electricity (12 periods)

4.1 Electric Current, Resistance, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.

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

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

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

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

5. Magneto Statics and Electromagnetism (12 periods)

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

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

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

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

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

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

6. Semiconductor physics (8 periods)

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

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

6.3 Semiconductor transistor, pnp and npn (concepts only)

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

7. Modern Physics (8 Periods)

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

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

7.3 Introduction to nanotechnology, nanoparticles and nano materials,

LIST OF PRACTICALS (To perform minimum six experiments)

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

INSTRUCTIONAL STATREGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

2.3 APPLIED MECHANICS

L	T	P
5	-	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

LEARNING OUTCOMES

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

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1. Introduction (06 periods)

   1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.

   1.2 Definition, basic quantities and derived quantities of basic units and derived units

   1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration

   1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 periods)

   2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

   2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition

   2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of

forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components

2.4 Free body diagram

2.5 Equilibrant force and its determination

2.6 Lami's theorem (concept only)

[Simple problems on above topics]

2.7 Type of Load, supports, Beams- analysis for simply supported, cantilever beams

3. Moment (14 periods)

3.1 Concept of moment

3.2 Moment of a force and units of moment

3.3 Varignon's theorem (definition only)

3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)

3.5 Parallel forces (like and unlike parallel force), calculating their resultant

3.6 Concept of couple, its properties and effects

3.7 General conditions of equilibrium of bodies under coplanar forces

3.8 Position of resultant force by moment

[Simple problems on the above topics]

4. Friction (14 periods)

4.1 Definition and concept of friction, types of friction, force of friction

4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.

4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane Horizontally

b) At some angle with the inclined plane

5. Centre of Gravity (10 periods)

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies

5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

6. Simple Machines (14 periods)

6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a

machine and their relationship, law of machines

6.2. Simple and compound machine (Examples)

6.3. Definition of ideal machine, reversible and self locking machine

6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency

6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

INSTRUCTIONAL STRATEGY

Applied Mechanics being a fundamental subject, the teacher are expected to emphasize on the application of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham,Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria& Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	8
2	12	18
3	14	20
4	14	20
5	10	14
6	14	20
Total	**70**	**100**

2.4 FUNDAMENTALS OF POLYMERS

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RATIONALE

"THE LIFE WITHOUT POLYMER IS VERY DIFFICULT. IT MAKES OUR LIVES VERY EASY." The Purpose of this Paper is to acquaint the students with primary knowledge of polymers i.e. different Polymers, their properties, Reactions, Polymerization Techniques, Classification, Molecular weight, Distribution of Molecular weight and their applications in different era of life.

LEARNING OUTCOMES

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

1. Understand the fundamentals of polymers.
2. Understand the classification of polymers.
3. Understand the polymerization mechanism.
4. Understand the polymerization reactions.
5. Understand the polymerization techniques.
6. Understand Kinetics of chain growth polymerization/step growth polymerization.
7. Analyse polymerization components for determination of molecular weight and molecular weight distribution of polymers, copolymers,etc.
8. Understand the different properties of polymer.
9. Understand the Identification and characterization of polymer.

DETAILED CONTENTS

Unit – I Introduction to Polymer Science (24 Periods)

The science of large molecules – Definitions – Monomers & its requirement- Broad Classifications of Polymers - Types based on Structure- Processing and Applications - Molecular Force and Chemical Bonding in Polymers –Polymer structure – Homo Polymers and Copolymers – Geometric Isomerism – Tacticity – Nomenclature – Molecular Weight and Distribution and its effect on Properties and Processing of Polymers- Thermal Transition – Tg and Tm.

Unit – II Polymerization (24 Periods)

Chain growth Polymerization – Addition Polymerisation – Reaction Mechanism - Free Radical Reaction – Ionic Reaction – Coordination Polymerization – Ring Opening Polymerization - Condensation Polymerization – Degree of Polymerisation – Polymerization Techniques – Bulk, Solution, Suspension and Emulsion Polymerization - Co-polymerization.

Unit – III Polymer Structure and Properties (18 Periods)

Structure – Property Relationship – Molecular Weight and Poly Dispersity Index (PDI) - Effect of Polymerization on PDI – Polymer solutions and solubility – General Rules

for Polymer solubility – solubility Parameters, Properties of Dilute solutions - Solid state properties – State of Polymer – Crystalline, Amorphous, Semi-crystalline, Liquid crystalline
– Requirement of Crystallinity – factors affecting crystallinity. Deformations in Polymer – Mechanical properties - Stress – Strain behavior – Polymer Fracture and Toughness – Cracking & Crazing – Thermal & Electrical properties.

Unit – IV Polymer Characterization (18 Periods)
Identification of Polymers – Simple Spectroscopic Methods – Molecular Weight Determination – Measuring Dilute Solution Viscosity – Gas Chromatography – Gel Permeation Chromatography – Melt Flow Characteristics - Thermal Analysis DSC and TGA
– Dynamic Mechanical Analysis.

INSTRUCTIONAL STRATEGY

Fundamentals of Polymer Science being a basic subject, the teacher is expected to emphasize on the basics of chemistry and then polymer chemistry. As this subject is a part of chemistry, teachers are expected to cover different aspects of chemical bonding, reactions, reaction mechanism etc. For identification Purposes students should also be made aware of different plastic identification techniques.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Polymer Science – Gowariker V.R. & others.
2. Text book of Polymer Science – Billmeyer F.W.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	24	30
2	24	30
3	18	20
4	18	20
Total	**84**	**100**

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2.5 ELEMENTARY WORKSHOP TECHNOLOGY

L	T	P
5	-	-

RATIONALE

The knowledge of " Workshop Technology " is very basis of Plastic Mould Technology practice. For a beginner to technician course, familiarity with hand tools is a matter of utmost importance. The classroom teaching and a practice in shop will meet this need well.

LEARNING OUTCOMES

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

1. Understand the importance of workshop in engineering diploma courses.
2. Describe different manufacturing processes in workshop.
3. Communicate effectively in shop floors with superiors and subordinates.
4. Apply different processes of workshop, as and when required.
5. Use safety equipment and personal protection equipments.
6. Identify the requirements of different tools / Machines.
7. Prevent the prepared job and used tools / machines from losses.
8. Follow safety procedures and precautionary measures.

DETAILED CONTENTS

1. GENERAL INTRODUCTION:

(a) Scope of subject "Workshop Technology" in engineering.

(b) Different shop activities and broad division of the shops on the basis of nature of work done such as

(i) Wooden Fabrication (Carpentry)

(ii) Metal Fabrication (shaping and Forming, Smithy, Sheet metal and Joining welding, Rivetting, Fitting and Plumbing)

(c) Organization and layout of workshop.

(d) General safety precaution in workshop

2. CARPENTRY :

(a) Types of wood and timber, Cutting and seasoning of wood, Decaying of wooden component.

(b) Fundamental of wood working operations:

- Marking & Measuring.
- Holding & Supporting.
- Cutting & Sawing.
- Drilling & Boring.
- Turning.
- Jointing.

(c) Common Carpentry Tools:

Their classification, size, specification (name of the parts and use only).

(1) Marking and measuring tools: Rules, try square, Bevel Square, Marking gauge, Mortise gauge, Scriber (marking knife). Combination set

(2) Holding and supporting Tools: Carpentry vice, Bench hold fast, Bar clamp, Bench hook, Hand clamp C and G clamp.
(3) Cutting and Sawing Tools: Saws: (Grip or Hand, panel, cross cut, Tenon, dovetail, compass, key hole and bow saw),
Chisel: (Firmer, dovetail, mortise and gauge),
Planes: (Wooden & Iron plane. Jack plane, Smoothing plane).
(4) Drilling and Boring tools: Auger, Gimlet, Hand drill, Brace and bits.
(5) Striking Tools: Mallet and Claw hammer.
(6) Turning Tools & Equipment: Wood working lathe and lathe tools.
(7) Miscellaneous Tools: Screw driver, Rasp, Pincer, Oilstone, Triangular file and Sawset.

(d) Joining of Timber Components For Fabrication Works: Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-Simple lap and butt, Mortise, Tenon, Dovetail, Mitre & briddle joints. Uses of glue, dowel pin and screw in preparation of joints.
Common defects likely to occur during and after joining, defects due to wrong use of tools, defects due to wrong operation, defects due to improper seasoning of timber, their identification and remedy. Safety (personal and equipment) to be observed.

3. METAL FABRICATION:
(A) Metal Shaping :

1.Smithy:

a) Operations involved (concept only)-Preparation of fire, Supporting and holding the metal, cutting the metal in size, heating, drawing down or fullering, upsetting, swaging, bending, punching, blanking, drifting and forge welding,
b) Tools and equipment used (Names, size, specification for identification only).
c) Heating and fuel handling equipment-Smithy Forge, Blower, Shovel, Poker.
d) Holding and supporting tools-Common tongs, anvil, swage block.
e) Striking Tools-Ball pein, cross pein, Straight pein double face and sledge hammers.
f) Cutting tools - Hot and cold chisel and shear set.
g) Punching & Drifting Tools - Punch & Drift.
h) Bending Tools and fixture.
i) Forming & Finishing Tools - Fullers, Swage Flatters, Set hammers.
j) Defects likely to Occur during and after operations their Identification and Remedy. Defects due to wrong operation, wrong tool and wrong heating.
k) Safety of Personnel, Equipment & Tools to be observed.
l) Study of forge hammers and power presses.

2. Sheet metal working:

a) Tools and Operation:
b) Operations involved (Names and concept only) Laying out, marking and measuring, cutting, Shearing and blanking, Straightening bending and seaming, Punching and piercing, burring and stamping,
c) Sheet metal joints - Lap, seam, Locked seam, hemp, wired edge, cup or circular, Flange, angular and cap.
d) Tools and equipment used (Name, size, specification for identification only).

e) Marking Tools- Scriber, Divider and Trammel, Protractor, Try square, Dot punch, Steel Rule, Steel tape, Sheet metal gauge.
f) Cutting and shearing Tools-hand Shear and lever, Snips, Chisels.
g) Straightening tool-Straight edge.
h) Striking Tools-Mallet, Hammer.
i) Holding Tools-Vice, Plier, C or G clamps, Tongs.
j) Supporting Tools-Stakes and Anvil.
k) Bending Tools-Crimpers, Form dies, Round no seplier, Rails.
l) Punching-Piercing and Drifting tools.
m) Burring Tools-Files.
n) Common defects likely to occur during and after operation-Their identification and remedy. Defects due to wrong operation or wrong tool.
o) Safety of Personnel, Equipment & Tools to be observed.
p) Development and estimation of sheet for simple articles.

(B) Metal Joining During Fabrication:

1. Permanent Joining:

a) Welding methods- gas welding (high and low pressure-oxyacetylene welding, types of flames. Electric welding- D.C. & A.C., Connected tools, operation, materials and safety measures.

b) Soldering & Brazing: For black Galvanized and Tin coated Iron sheet, brass and copper sheets only.
   i. Its concept, comparison with welding as joining method and classification, electric soldering and forge soldering.
   ii. Soldering operation- edge preparation of joints, Pickling and degreasing, Fluxing, Tinning and Soldering.
   iii. Materials Used-Common fluxes, soft and hard solder, solder wire (Plain and Resin core) and sticks, spelters and their specifications and description (For Identification Only), forge soldering bits.
   iv. Electric soldering iron.
   v. Common defects likely to occurs during and after soldering.
   vi. Safety of Personnel, Equipment & Tools to be observed.

c) Rivetting:
   i. Its comparison with welding as joining method.
   ii. Rivets and Materials.
   iii. Operation involved-Marking from given data, edge preparation, drilling and punching arrangements of joint elements (Lap, Butt with single cover plate and double cover plate)upsetting of rievet tail, shaping head and caulking.
   iv. Tools and equipments used- (Names, Size, Specification and uses)-Supporting and holding tools (Stakes and Tonqs)-Striking tools-Ball pien, Straight pien and Cross pien hammers and head forming tools (Shapes), drills punches and solid punches, drift, elementary knowledge about working of pneumatic, hydraulic and electric rivetor.

2. Temporary Joining (Fastners & Their Uses):
Introduction to

a) Various types of Bolts (Names of prats and specification) and various types of washers and nuts used with them and their uses, material they are made of, studs and foundation bolts.
b) Screws, keys, pins and cottors-their material and use.
c) Pipe connectors-Sockets, elbows, tees, cross and bends, unions, volves, glands packing and operation in use of pipe connectors-cutting, marking, threading, pipe bending, joining different pipe line fittings- (Steps of operation only).
Tools and equipment used in their operations (Name, Size, Specification and Description for Identification).
Supporting and holding tools-Pipe vices (Bench, leg and hand), Pipe wrenches, Spanners.
Cutting Tools- Hack saw and Pipe cutters.
Threading Tools- Pipe dies and Taps.
Materials Used for Joining-White lead, Cotton and Gasket.
Common defects likely to occur during and after operation and their remedies.

(C) Familiarity with The Use of Various Tools Used In Mechanical Engineering Workshop:

Marking & Measuring: Steel rule, surface gauge, marking block, protractor, try square, scriber, punches, divider and callipers, surface plate, V. block, gauges- (screw, pitch, radius, feeler), Vernier callipers, Micrometer, Vernier height and depth gauge, use of dial gauge.
Holding Tools: Vices (Bench, leg and hand vice), clamps tongs, pliers,
Cutting Tools: Hack saw (Fixed and Adjustable frame), chisels-flat, cross cut, diamond, round nose.
Files: According to section-Knife edge, Flat, Triangular Round, Square, Half round,
According to grade - Rough, Bastard, Second cut, Smooth and Dead smooth,
Drills and Allied Tools: Parallel and taper shank Twist drill,
Thread Cutting Tools: Taps and Dies,
Miscellaneous Tools: Wrenches, Keys, Spaners, Pliers, Screw drivers their specification and many others which have not been named for use in various shops. They should be shown physically to each student for familiarity.

4. PROTECTION OF FABRICATED STRUCTURES FROM WEATHER:

(A) PAINTING:

Its need, Introduction to methods of paintings (Classification only); Manual, Machine (spray) and dip painting at room temperature, operations involved description of steps only eg. surface preparation method for old and new surface in timber and iron structure-sanding, de rusting, de qreasing, filling of pore and dents, paint application- manual, machine (spray and dip painting) drying of paint, air drying and oven drying under coat and filler material (red oxide, putty, yellow clay), surface preparation materials (sand and emery papers); tools and equipment used (Name, size specification for identification).
Brushes-Round and flat wire brush, scraper, trowel , spray gun, compressor.
Defects likely to occur in painting and their remedies, Safety of Personnel, Equipment & Tools to be observed.

(B) VARNISHING & POLISHING:

Its need operation involved (description of step only),surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish, copal varnish. Defects likely to occur. Safety of Personnel, Equipment & Tools to be observed.

5. FOUNDRY WORK:

Elementary idea of patterns, Types of moulds, sand and greensand moulds and moulding, tools and equipment used in greensand moulding.

6. MACHINE SHOP:

Introduction to machine tools viz lathe, drilling machine, shaper and planer simple line and block diagram of components and their functions. Brief concept of NC and CNC machines.

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in different shops regularly in concerned practical activities for the practical / real feeling of topics, being taught through theory.

MEANS OF ASSESSMENT

- Assignments and quizzes / class tests.mid semester and end semester examinations.
- Practical work, exercises, job making and viva voce.
-

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	15	20
2.	15	20
3.	25	35
4.	15	25

Total	**70**	**100**

2.6 GENERAL WORKSHOP PRACTICE –II

L	T	P
-	-	8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and 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 OUTCOMES

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

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

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the 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 Fitting Shop
2 Sheet Metal Shop
3 Welding Shop
4 Foundry Shop
5 Machine Shop

1. FITTING SHOP

1.1 Use of personal protective equipment and safety precautions while working.
1.2 Basic deburring processes.
1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
1.5 Identification of various steel sections (flat, angle, channel, bar etc.).
1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).
1.7 Job Practice

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

2. SHEET METAL SHOP

2.1 Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
2.1 Introduction and demonstration of hand tools used in sheet metal shop.
2.2 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,
2.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
2.5 Study of various types of nuts, bolts, rivets, screws etc.
2.6 Job Practice
Job I: Shearing practice on a sheet using hand shears.
Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.
Job III: Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

3 WELDING SHOP – I

3.1 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.

3.2 Job Practice

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 T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

4 FOUNDRY SHOP

4.1Study of metal and non metals
4.2Study and Sketch of the Foundry tools
4.3Study and sketch of Cupola and pit furnace
4.4To prepare green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)
4.5.Casting of non ferrous (lead or aluminium)

5 MACHINE SHOP

5.1Study and sketch of lathe machine
5.2Study and Sketch of grinders, milling machine, drilling machine and CNC machine.
5.3Plain and step turning and knurling practice.
5.4Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic 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.

3.1 APPLIED MATHEMATICS –III

L-T-P
5-0-0

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Matrices (16 Periods)

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

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

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

1.4 Eigen Pairs, Cayley-Hamilton Theorem

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

2. Differential Calculus (15 Periods)

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation

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

2.3 Vector Calculus

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

3. Differential Equation (15 Periods)

3.1 Formation, Order, Degree, Types, Solution

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

3.2 First Order Equations

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

3.3 Higher Order Linear Equation :

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

3.4 Simple Applications

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

4. Integral Calculus-II (12 Periods)

4.1 Beta and Gamma Functions

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

4.2 Fourier Series

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

4.3 Laplace Transform

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

5. Probability and Statistics (12 Periods)

5.1 Probability

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution

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

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

3.2 PLASTICS MATERIALS – I

L-T-P

6-0-0

RATIONALE

The Purpose of this Paper is to acquaint the students with knowledge of polymers nomenclature. The production processes involve in the manufacturing of commodity plastic of different class of thermoplastic and thermosetting plastics and their applications in different areas.

LEARNING OUTCOMES

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

1. Understand the Nomenclature of polymers.
2. Understand the different of class of polymers.
3. Understand the production of thermoplastic.
4. Understand the production of thermoset plastic.
5. Understand the applications of different class of polymers.

DETAILED CONTENTS

Unit – I Natural Polymer (14 Periods)

Nomenclature of Polymers –Sources of Raw Materials , Methods of Manufacture , General Characters & Properties, processing behaviour and applications of natural polymers such as Shellac Resin , Natural Rubber , Casein.

Unit – II Commodity Plastics - Olefinic & Styrenic Plastics (25 Periods)

Sources of Raw Materials , Method of Manufacture , General Characteristics & Properties , Processing Behaviour and applications of

Low Density Polyethylene, Linear Low Density Polyethylene, High Density Polyethylene, High Molecular weight High Density Polyethylene, Polypropylene (Homo & Copolymer), Polystyrene, High Impact Polystyrene, Acrylonitrile Butadiene Styrene , Styrene Acrylonitrile Expanded Polystyrene

Unit , III Commodity Plastics - Vinyl & Cellulosic Plastics (25 Periods)

Sources of Raw Materials , Method of Manufacture , General Characteristics & Properties , Processing Behaviour and applications of

Polyvinyl chloride & Chlorinated Polyvinyl chloride, Polyvinylidene Chloride, Polyvinyl Acetate, Polyvinyl Alcohol, Cellulose Nitrate, Cellulose Acetate, Cellulose Acetate Butyrate, Regenerated Cellulose. Polymethyl Methacrylate, Polyacrylonitrile, Thermoplastic Elastomers.

Unit – IV Thermoset Plastics (20 Periods)

Source of Raw Materials , Methods of Manufacture , General Characters & Properties , Processing Behaviour and Applications of Phenol Formaldehyde , Urea Formaldehyde , Melamine Formaldehyde , Unsaturated Polyesters , Alkyd Resins , Epoxy Resin , Polyurethane , Silicones.

INSTRUCTONAL STRATEGY

The teacher is expected to emphasize on the basics of chemistry and then production process using flow chart and flow diagram. Emphasis should be given on different processes used for production of polymers.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1 Plastic Materials , J.A. Brydson.
2 Plastic Materials Hand Book , A.S. Athalye.
3 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	14	15
2.	25	30
3.	25	30
4	20	25
Total	**84**	**100**

3.3 Materials & Metallurgy

L-T-P
4-2-4

RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Materials and Metallurgy has been designed to cover the above aspects.

Learning Outcomes:

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

1. Understand various types of metal and non-metals, their properties
2. Understand metallurgical aspects of metals and non metals
3. Understand identification and testing of metals and alloys
4. Understand process of selection and knowledge of commercial availability of materials

DETAILED CONTENTS

1. Importance of Materials (10 Periods)

Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys
Names of common metals, their alloys and non-metals used in Industry
Properties of metals and alloys , Physical properties - Appearance, luster, colour, density and melting point , Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep.
Thermal and electrical conductivity Corrosion, causes, effects and prevention.

2. Metallurgical Considerations (14 Periods)

Solidification of metals form liquid to solid state of pure metals, cooling curves of pure metals, dendritic solidification, crystal formation, types of crystal structure. Phase diagram of:
(i) Solid-state solubility.
(ii) Partial solubility.
(iii) Nil solubility i.e. eutectic solution (Binary only). Effects of all alloying elements on engineering materials. Effect of grain size on mechanical properties.

3. Ferrous Metals and Alloys (14 Periods)

Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram. Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades , Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels. Composition, properties, grades and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.

Heat treatment: Iron-carbon diagram, objectives and practical aspects of Heat treatment. Brief description and uses with examples of principal Heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Examples in heat-treating engineering components time, temperature transformation curve.

4. Non-ferrous Metals and Alloys (14 Periods)

Copper: Properties and uses , Composition, properties and uses of copper alloys.

Brasses: Cartridge brass, Nickel silver.

Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.

Properties and uses of Aluminium.

Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium

Properties and uses of alloys of lead, tin and magnesium.

Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi- metallic and tri-metallic bushes

5. Identification and Examination of Metals and Alloys (4 Periods)

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure. Different types of etchants for preparation of surface structure.

6. Other Important Materials (10 Periods)

Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.

Electrical insulating materials. Properties and uses of China clay, leather, Bakelite, ebonite, glass wool, rubber, felt.

Sound insulating materials: Cork, fibre boards.

Fabrication materials: Wood, plywood, rubber , natural and synthetic, Glass , plate glass, toughened glass, safety glass.

Refractory materials: General characteristics and uses of dolomite, ceramics.

Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating.

Sealant and adhesives , Application and availability of sealant and adhesives for industrial user.

7. Selection, specifications and commercial availability of materials (08 Periods)

Practical considerations for selection of material for different purposes

ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

MATERIALS AND METALLURGY LAB

LIST OF PRACTICALS

1.Classification of about 25 specimen of materials/parts in material lab, identify and indicate the type of materials with respect to their properties

2. Study of metallurgical microscope.

3.To prepare microscopic structure for examination and to examine the micro structure of specimens of various metals and alloys.

4.Study of heat treatment furnaces.

5.To study the effects of heat treatments processes on the following materials:

(i) Low carbon steel

(ii) Mild steel

(iii) High Carbon Steel

INSTRUCTONAL STRATEGY

Teachers are expected to lay considerable stress on the classifications and applications of engineering materials and the metallurgical aspects should be taught with the help of various compatible curves, showing the practical importance of salient points. Identification and testing of the material strategy should be strictly as per industrial applications.

MEANS OF ASSESSMENT10

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Material Science Engineering(Hindi) Textbook Y.D. Sharma, R.P. Garg, Standard Publications & Distributors

2 Engineering materials and metallurgy by R.K. Rajput, S. Chand Publications

3 Material Science & Metallurgy by A.V.K. Suryanarayana, BS Publications

4 Metallurgical Engineering, Objective Type & Short Answers by Arvind Kumar, Khanna Publications

5 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	14	17
3	14	17
4	14	17
5	04	04
6	20	24
7	08	09
Total	**84**	**100**

3.4 Plastic Testing-I

L-T-P
6-0-4

RATIONALE

The Purpose of this Paper is to acquaint the students with knowledge of polymers identification & testing. The different plastic properties are being analysed with the help of visual, physical, chemical means of test.

LEARNING OUTCOMES

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

- Understand the identification of polymers.
- Understand the testing of polymers.
- Understand the characterization of polymers.
- Knowledge of Mechanical and thermal properties of materials

DETAILED CONTENTS

Unit – I Concepts of Testing & Identification of Plastics (20 Periods)

Basic concepts of testing - Specification and Standards - National and International Standards - Test specimen preparation - Pre-conditioning and test atmosphere. Identification of plastics by simple tests - Visual examination - Density - Melting point - Solubility test - Flame test - Chemical tests, Density by Density-gradient column, Particle size by sieve analysis and moisture content analysis

Unit –II Material Characterization (18 Periods)

Introduction - Melt Flow index – Viscosity , Dilute Solution Viscosity , Material Characterization Tests for Thermosets , Apparent (bulk) Density, Bulk Factor, Cup & Spiral Flow Test, Dynamic Viscosity (Brook field viscometer)

Unit –III Mechanical Properties (24 Periods)

Short-term Mechanical Properties: Tensile properties - Flexural properties - Compressive properties - Shear properties - Impact properties - Tear resistance - Hardness - Abrasion resistance , Frictional properties, Long-term Mechanical Properties - Creep and Stress relaxation

Unit – IV Thermal Properties (22 Periods)

Introduction, Short Term Tests – Determination of Heat Distortion Temperature (HDT), Vicat Softening Temperature (VST), Long Term Heat Resistant Tests, Thermal Conductivity, Thermal Expansion, Brittleness Temperature

PLASTICS TESTING LAB – I

1 Identification of Plastics by Simple methods
2 Primary Tests , Elemental Analysis , Confirmation Tests

3 Determination of Density by Displacement Method
4 Determination of Melting Point
5 Determination of Filler Content
6 Determination of Moisture Content
7 Determination of Volatile Content
8 Determination of Ash Content and Loss on Ignition
9 Determination of Linear Shrinkage and Shrinkage on Transverse Direction
10 Determination of Carbon Black Content and Dispersion
11 Determination of Rate of Burning
12 Determination of Dilute Solution Viscosity
13 Determination of K-value for PVC resin

INSTRUCTONAL STRATEGY

This subject should be taught with the aid of different testing setup for mechanical testing and plastic testing too. The teacher is expected to emphasize on the basics of identifications methods using flow diagram. The characterisation techniques used should be elaborated to the students.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K..Nayak
2 Plastics Testing Technology Hand Book , Shah Vishu
3 Simple Methods for Identification of Plastics , Dietrich Braun
4 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	20	20
2	18	25
3	24	30
4	22	25
Total	**84**	**100**

3.5 Mould Manufacturing

L-T-P
4-2-0

RATIONALE

Moulds are the prime requirements for the foundry shops. Plastic moulds are extensively used in casting industries. Keeping in mind the above aspects this subject has been introduced herewith.

LEARNING OUTCOMES

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

1. Understand the mould making materials.
2. Understand the different mechanical operations used in mould making.
3. Understand the different techniques/tools used in mould making.
4. Understand the mould policing and finishing operations.
5. Understand the scope of mould maintenance and its method.

DETAILED CONTENTS

Unit – I Material for Moulds (20 Periods)

Mould Steel Requirement , Characteristics , Alloying Elements , Material Selection for Different Parts of the Mould , Non Ferrous Materials , Aluminum - Copper , Bronze , Beryllium Copper , heat treatment and its significance in Mould manufacturing.

Unit – II Mould Making Techniques - Conventional methods (25 Periods)

Introduction of mould parts and manufacturing, Different types of machines used, Cutting Tools - Tool Materials. Study of various machining operations -Turning, Shaping, Planning, Drilling, Grinding (Surface, Cylindrical), Milling (Horizontal / Vertical). Manufacturing of various mould elements.

Unit – III Mould Making Techniques - Special Machine Tools (25 Periods)

Introduction to Special Machine Tools - Jig Boring Machine, Pentograph, Electrical Discharge Machining (EDM) , Working Principle , Cutting Tools used in Mould manufacturing and maintenance. , wire cut and applications Introduction of CNC Machines - Types - Application of CNC machines for mould making and maintenance.

Unit - IV Mould Polishing & Assembly (25 Periods)

Polishing Technology in Mold Making - Definition of Surface Roughness, Basics of Polishing Technology, Effect of Mold Materials on Polishability, Types of Polishing Tools, Methods of Polishing - Basic Information on Ultra Sonic Polishing , Principles of Electro Deposition in Damaged Molding Surfaces / Protective Coating. Mould Assembly - Check list for Mould Assembly - Fitting and Assembly of various Mould Elements- Core Insert, Cavity Insert, Sprue Bush - Ejection System Assembly - Blue Matching and Die Spotting-Venting - Final Inspection - Fitting of Locating Ring and carrier bar.

Unit – V
Mould Maintenance (25 Periods)

Mould Maintenance , Purpose , Scope , Responsibility - Aspects of Upkeep and Maintenance of Moulds - Specification sheets - History sheets - Instruction Manual- Factors for Physical Mould Life - Maintenance Frequency - Break Down Maintenance - Suggested Tools available for proper tool maintenance - Maintenance list - Preventive maintenance - Mould Removing, Cleaning and Storage.

INSTRUCTONAL STRATEGY

This subject should be taught from mould introduction . Exposure of special machine tools should be physically there. Instructors are required to pay special focus in maintenance of moulds. The content of this subject are very important to the students. The teachers should acknowledge different aspect of materials used for the mold making and explain the same to the students.

INSTRUCTONAL STRATEGY

This subject should be taught from mould introduction . Exposure of special machine tools should be physically there. Instructors are required to pay special focus in maintenance of moulds. The content of this subject are very important to the students. The teachers should acknowledge different aspect of materials used for the mold making and explain the same to the students.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Mould Making Hand Book, Stoeckert.
2 Plastics Moulds and Dies, Sors.
3 Injection Moulds, V.D.I.
4 Injection Mould Design ,Pye R.G.W.
5 Production Technology - Er.R.K. Jain.
6 Production Technology - P.C. Sharma Pub: S. Chand and Co.
7 Workshop Technology, Volume I & II , W.A.J Chapman.
8 Elements of Workshop Technology-S.K.Hajra Choudhury & A.K Hajra Choudhury.
9 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	12	08
2	25	23
3	25	23
4	25	23
5	25	23
Total	**112**	**100**

3.6 Plastic Processing Techniques-I

L-T-P

5-0-4

RATIONALE

The purpose of this subject is to equip the students with the knowledge of processes utilized in Injection molding, extrusion and blow moulding. This subject develops the competence of the students in major industrially practiced processing techniques.

Learning Outcome

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

1. Explain injection moulding process
2. Understand process of extrusion, classifications, & the performance of extruder.
3. Understand the Knowledge of printing techniques.
4. Understand process of blow moulding and the associated products

DETAILED CONTENTS

a) INJECTION (24 Periods)

Basic concept of injection moulding: Hand injection, Semiautomatic injection (vertical and horizontal) and features of machine. Automatic injection moulding machine: Various machine parts like; hopper, screw, barrel, heating devices, clamping unit etc. Injection moulding process and process control, machine parameter, shot capacity, injection pressure, injection speed, day light, limit switch etc., Basic concept of injection cycle, machine control, microprocessor controlled injection moulding, open loop and close loop control, multi colour injection moulding, gas assisted injection moulding, isotactic moulding, faults and remedies in injection moulding process like: Shrinkage, shrink mark, weld line parting line, flash etc.

b) EXTRUSION (24 Periods)

1.Introduction

Introduction to extrusion process, different types of extruders:- single screw and twin screw extruder, vented barrel extruder, general principles of operation, die swell, function of various parts i.e. barrel, screw, screenpack, die, breaker plate, adaptor.

2. Types of screws in use for processing different plastics, Feed, Compression and Metering zone, Die zone, L/D ratio and its significance.

3. Nip rolls, bubble casing, winding equipment, cutting devices, stretching and orientation.

4. Extruder performance and their curves, faults & remedies.

5. Blown film extrusion, extrusion of pipes, wires and cables, sheets and Filaments.

6. Co extrusion of films and sheets.

7. Printing techniques , flexographic printing, gravure printing, pad printing, screen printing, hot stamping.

8. Conversion of plastic films into laminate e.g. metal plastic laminates, paper- plastic laminates, plastic - plastic laminates. Advantages of multi- layer packaging, disadvantages of multi-layer packaging.

c) BLOW MOULDING (22 Periods)

1. Basic principles of blow moulding, Types of blow moulding :- Extrusion blow moulding, injection blow moulding. Blow molding irregular containers.

2. Materials for blow moulding.

3. Production of parison, a). by extrusion b). by injection. Parison wall thickness control, Parison blowing systems, air requirement for blowing, effect of process variables on product design and properties. Parison programming, mould venting.

4. Newer concepts including extrusion- stretch blow moulding, injection stretch blow moulding, multi layer moulding etc.

PLASTICS PROCESSING TECHNIQUES –I LAB

LIST OF PRACTICALS

1.To study the specification of extruder available in the lab

2.To produce pipe of different diameters on extruder

3.To study the specification of automatic Blow Moulding Machine

4.Production of component on hand operated blow molding machine, using at least 3 moulds

5.Production of components on semi-automatic blow machine by setting the process parameters

6.To do gravure printing

7.To do printing with pad printing machines

8. To study & operation of Injection Molding machine with complete specifications.

INSTRUCTONAL STRATEGY

This subjects should be taught with the aids available. The students should be visited a unit having Injection molding, extrusion & Blow molding operations of various injection moulding machine, extrusion machine and blow moulding machine.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Injection Moulding theory & practice-Rubin, Irvin
2 Plastics Processing Technology by Edward A. Muccio.
3 Plastic Materials & Processing , Brent Strong
4 Plastic Engineering Hand Book- Society of Plastic Industry Inc.
5 Plastic Processing data Hand Book- D.V. Rasato
6 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
A	24	35
B	24	35
C	22	30
Total	**70**	**100**

4.1 COMMUNICATION SKILLS – II

L -T-P
4-0-2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

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

2 Reading (16 periods)

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

3 Writing Skill (24 periods)

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

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a by-product.

Speaking and Listening Skills

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

Websites for Reference:

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

SUGGESTED DISTRIBUTION OF MARKS

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

4.2 HYDRAULICS AND PNEUMATICS SYSTEMS

L	T	P
5	1	2

RATIONALE

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

LEARNING OUTCOMES

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

- Explain fluid properties, their units and conversion.
- Measure different types of pressures.
- Maintain different types of pressure gauges.
- Calculate flow and discharge of various liquids.
- Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.
- Calculate pipe friction and losses in pipelines.
- Specify hydraulic machines for different applications.
- Apply Pascal's law in practical applications.
- Explain the functions of various components used in hydraulic and pneumatic system.
- Maintain hydraulic and pneumatic system.

DETAILED CONTENTS

1. Introduction (06 Periods)

   Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.

2. Pressure and its Measurement (07 Periods)

   2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
   2.2 Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems
   2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

3. Flow of Fluids (09 Periods)

Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venturi-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem simple problems.

4. Flow through Pipes (10 Periods)

4.1 Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction; siphon, power developed. Water hammer, anchor block, syphon, surge tank (concept only).

4.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof)

5. Hydraulic System (05 Periods)

Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press.

6. Water Turbines and Pumps (14 Periods)

6.1 Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, Cavitations.

6.2 Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.

6.3 Construction, working and operation of centrigual pump. Performance, efficiencies and specifications of a centrifugal pump, pitting, cavitation, priming.

7. Introduction to Oil Power Hydraulics and Pneumatics (05 Periods)

7.1 Introduction to oil power hydraulic and pneumatic system

7.2 Statement of Pascal law and its applications

7.3 Industrial applications of oil power hydraulic and pneumatic system

8. Components of Hydraulic Systems (06 Periods)

8.1 Basic components of hydraulic system, function of each component in a hydraulic circuit.

8.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,

8.3 Filters- definition and purpose, classification

8.4 Seals and packing- classification of seals, sealing materials.

9. Components of Pneumatic Systems (08 Periods)

9.1 Basic components – function of each component

9.2 Air compressors - Introduction

9.3 Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tanden cylinder, double ended cylinder, duplex cylinder.

9.4 Air filter, regulator and lubricator – their necessity in pneumatic circuit.

9.5 Installation, maintenance and application of air cylinders.

LIST OF PRACTICALS

1. Measurement of pressure head by employing.
   i) Piezometer tube
   ii) Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.
9. Direct operation of single and double acting cylinder.
10. Automatic operation of double acting cylinder in single cycle using limit switch.
11. Operation of double acting cylinder with quick exhaust wall.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

RECOMMENDED BOOKS

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.

3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.
10. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Website for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	08
2	07	10
3	09	12
4	10	15
5	05	08
6	14	20
7	05	07
8	06	08
9	08	12
Total	**70**	**100**

4.3 Plastic Materials -II

L	T	P
5	-	-

RATIONALE

Plastic components are integral part of various engineering industries . Polymers blends and alloys are also incorporated. To understand various polymerization techniques and catalysts used to produce addition polymers. To understand the copolymerization technique to produce important co-polymers. To learn the manufacturing of thermosetting molding powders from phenol formaldehyde and melamine.

LEARNING OUTCOMES

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

1. Gain knowledge of Engineering Plastics & their methods of manufacturing
2. Gain knowledge of Special usage plastics & their methods of manufacturing
3. Understand polymer blends and alloys
4. Explain bio-plastics and biodegradable plastics & The Importance of Bio Polymer.

DETAILED CONTENTS

Unit – I Engineering Plastics (35 Periods)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of Engineering Plastics -Polyoxymethylene, Polyamide (PA6, PA66, PA610, PA11, PA12 and PA46), Polyesters (PET, PBT), Poly Carbonate , Polyphenylene Oxide, UHMWHDPE, Polytetrafluoroethylene, Polyvinyl fluoride, Polyvinylidene fluoride, Thermoplastics Polyurethane

Unit – II Speciality Plastics (35 Periods)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of Polysulphone,, Polyphenylene sulphide, Polyarylsulphone, Polyether Ketone, Polyether Ether Ketone, Polyimide, Polyamideimide, Liquid CrystalPolymers.

Unit – III Polymer Blends&Alloys (30Periods)

Introduction to polymer blends & alloys - Definitions and nomenclature - reasons for making polymer blend - how to select blend components - preparation of alloys & blends - economy of blending.

Unit – IV Bio-degradable Plastics & Bioplastics (12 Periods)

Overview of Plastics degradation - Natural Bio-degradable Polymers - Synthetic Bio- degradable Polymers - Water soluble Polymers.

INSTRUCTONAL STRATEGY

The teacher is expected to emphasize on the basics of chemistry and then production process using flow chart and flow diagram. Emphasis should be given on different processes used for production of polymers.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Plastic Materials Hand Book – A.S. Athalye.
2 J. A. Brydson, " Polymer Materials ", Butterworth-Heinemann, 1990.
3 Mark &Overberger, " Encyclopedia of Polymer Science & Tech. " Wiley-Interscience, 1986.
4 J. Scheries& W. Kaminsky, " Metallocene based Polymers ", Wiley, 2000.
5 Vasant R. Gowariker, "Polymer Science ", New Age International, 1986.
6 Christopher C. Ibeh, " Thermoplastic Materials: Properties, Manufacturing Methods, and Applications ", Taylor and Francis Group, 2011.
7 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	24	35
2	24	35
3	20	15
4	16	15
Total	**84**	**100**

4.4 DESIGN OF DIES AND MOULDS-I

L T
P
4 1 4

RATIONALE

A diploma holder in plastic technology is engaged in manufacturing plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skill in design of moulds and dies.

Learning Outcome

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

1. Explain basic concepts of mould design
2. Explain various types of die and mould materials
3. Explain machining methods, feed systems, ejection system, cooling systems
4. Gain Knowledge of different parts of moulds

DETAILED CONTENTS

1. Basic concept of mould designing, shrinkage, flash line, taper and draft (04 Periods)

2. Materials used for dies and moulds and their characteristics (04 Periods)

3. General design considerations for various types of moulds (04 Periods)

4. Machining methods - general introduction to lathe machine, grinder, shaper, milling, spark erosion, CNC wire cut (06 Periods)

5. Impressions – Core and cavity. Types of cavity and core, their advantages and disadvantages. Bolster plate and its types, guide piller, guide bush, register ring and their types. Mould clamping – direct,indirect (06 Periods)

6. Parting surface – Types of parting surface, selection of parting surface (06 Periods)

7. Feed system - Runners – Sprue, runners and its types, balancing of runners, size of runners

- Gates – Types of gates, size of gates (10 Periods)

8. Ejection system – Ejector grid, ejector plate assembly (10 Periods)

9. Cooling system – Cooling methods, cooling circuits for an integer and insert core cavity moulds e.g. U-type, rectangular and Z-type (05 Periods)

10. Injection mould – Types of moulds; 2-plate mould, 3-plate mould, split mould, runnerless mould (15 Periods)

DESIGN OF DIES AND MOULDS-I LAB

LIST OF PRACTICALS

1. To design and draw various mould parts
2. To design and draw a two-plate injection mould
3. To design and draw a three-plate injection mould
4. To design and draw a split mould
5. To design and draw a runner less mould
6. To design & draw unscrewing.

Note: Maximum 10 sheets will be prepared by the students

INSTRUCTONAL STRATEGY

Students should be encouraged to go through at least one mould design software comprising of analysis of moulds. The Teacher should visit a mold unit manufacturing the product with injection molding for physical/Practical observation of the mold students.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1. Handbook of Mould, tool & Die repairing, S. Thompson
2. S.P. S Handbook of plastics by J. Frados
3. Plastic Engineering by RJ Crawford, Maxwell Macmillan International Editions Publications
4. Injection Moulding Handbook by Dominiok V. Rosato and Donald V Rosato
5. Plastic mould Engineering Handbook by J. Harry Don Boss and Mayne & Pribble, Van Nostrand Reinhold Company Publication
6. Mould Making Hand Book,Stoeckert.
7. Plastics Moulds and Dies,Sors.
8. Injection Moulds, V.D.I.
9. Injection Mould Design –PyeR.G.W.
10. Production Technology - Er.R.K.Jain.
11. Production Technology - P.C. Sharma Pub: S. Chand andCo.
12. Workshop Technology, Volume I & II – W.A.JChapman.
13. Elements of Workshop Technology-S.K.Hajra Choudhury & A.K HajraChoudhury.
14. E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	6
2	4	6
3	4	6
4	6	8
5	6	8
6	6	8
7	10	12
8	10	12
9	5	6
10	15	18
Total	**70**	**100**

4.5 ENVIRONMENTAL STUDIES

L	T	P
3	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Introduction (04 Periods)

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

2. Air Pollution (04 Periods)

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

3. Water Pollution (08 Periods)

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

4. Soil Pollution (06 Periods)

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

5. Noise pollution (06 Periods)

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

6. Environmental Legislation (08 Periods)

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

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

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

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
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; S K Kataria and Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

4.6 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Basics of Energy

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

2. Energy Conservation and EC Act 2001

    2.1 Introduction to energy management, energy conservation, energy efficiency and its need

2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.

2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating

3. Electrical Supply System and Motors

3.1 Types of electrical supply system

3.2 Single line diagram

3.3 Losses in electrical power distribution system

3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers

3.6 Electric Motors

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

4. Energy Efficiency in Electrical Utilities

4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps

4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.

4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5. Lighting and DG Systems

5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting

5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation

6. Energy Efficiency in Thermal Utilities

6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess

air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces

6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers

6.4 Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features

7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

8. Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery

8.2 Concept and types of co-generation system

9. General Energy Saving Tips

Energy saving tips in:

9.1 Lighting

9.2 Room Air Conditioner

9.3 Refrigerator

9.4 Water Heater

9.5 Computer

9.6 Fan, Heater, Blower and Washing Machine

9.7 Colour Television

9.8 Water Pump

9.9 Cooking

9.10 Transport

10. Energy Audit

10.1 Types and methodology

10.2 Energy audit instruments

10.3 Energy auditing reporting format

PRACTICAL EXERCISES

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.

4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

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

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

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

Important Links:

(i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.
(ii) Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.

(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

(iv) **Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

(v) Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.

(vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

INDUSTRIAL TRAINING

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

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

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

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

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

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

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

5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
5	-	-

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. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. Introduction (04 Periods)

1.1 Concept /Meaning and its need

1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship

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

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

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

2.1 Scanning of the business environment
2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities
2.3 Types and conduct of market survey
2.4 Assessment of demand and supply in potential areas of growth
2.5 Identifying business opportunity
2.6 Considerations in product selection
2.7 Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)

3.1 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
3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

4.1 Definitions and importance of management
4.2 Functions of management: Importance and process of planning, organising, staffing, directing and controlling
4.3 Principles of management (Henri Fayol, F.W. Taylor)
4.4 Concept and structure of an organisation
4.5 Types of industrial organisations and their advantages
4.6 Line organisation, staff organisation
4.7 Line and staff organisation
4.8 Functional Organisation

5. Leadership and Motivation (08 Periods)

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

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

6. Management Scope in Different Areas (14 Periods)

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

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

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

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

7. Work Culture (08 Periods)

7.1 Introduction and importance of Healthy Work Culture in organization
7.2 Components of Culture
7.3 Importance of attitude, values and behavior
7.4 Behavioural Science – Individual and group behavior.
7.5 Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

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

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

9. Miscellaneous Topics (10 Periods)

9.1 Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)
9.2 Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert

lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

5.2 PLASTIC PROCESSING TECHNIQUES - II

L T P
5 2 7

RATIONALE

After fabrication of the product post processing operations are necessary to make the product commercially presentable. Finishing and other decorating and printing operations are instrumental in enhancing the aesthetics and visual appeal of the product. The emphasis is given especially on printing, lamination, coating techniques, compression and transfer moulding and rotational moulding.

Learning Outcome

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

1. Explain compression moulding, transfer moulding process and different parameters of these techniques.
2. Understand pultrusion and hand lay-up techniques.
3. Gain knowledge of rotational molding process.

DETAILED CONTENTS

1. Compression moulding (16 Periods)

General principles and working of compression molding machine.Types of compression molding machine – hand operated, automatic,single and multi daylight machines, bulk factor, preheating, Compression molds, cycle time ,process variables and their control. Effect of processvariables on product properties, compression molding of Semiconductorand DMC compounds.

2. Transfer Moulding (16 Periods)

Principles of transfer molding. Types of transfer molding machines,moldingcycle ,theoretical calculation of line pressure, injection rampressure, clamping pressure, pot capacity,compression force transfermolding and compression molding.

3. Introduction to Pultrusion, hand lay up technique (10 Periods)

Introduction to Pultrusion & hand lay-up techniques & their application for fibre reinforced plastic fabrication. Study of Pultrusion machine and their specification.

4. Forming (10 Periods)

Basic principles, method of forming – straight forming, free forming,plug assist forming, drape forming, matched mold forming, slipforming, snap back forming, reverse draw forming, limitations andadvantages of forming, materials for thermoforming, types of heatingsystems

5. Casting (10 Periods)

History, Basic process, Different Casting Processes, Sheet casting of M.M.A, unsaturated polyesters and phenolicresins.

6. Calendaring (10 Periods)

Introduction to calendaring, types of calendars, advantages, limitations of calendaring and major applications

7. Rotational moulding of large containers (12 Periods)

The basic principal of rotational molding process and material, Types of rotation molding machines, Single spindle, Multiple spindle, Straight spindle and Jacketed molding rational machine, Application of rotational molding. Faults & Their Remedies in rotational molding process.

8. Foam Moulding (07 Periods)

Foaming process and types of foaming. Application of foaming process. Analysis of faults and their remedies in foaming process. Definition of molding, processes, blowing agents, applications

9. Finishing of Plastics (07 Periods)

Machining of plastics in the form of sheets, rods and bulks. Finishing operations; Cutting, Filing, tumbling, grinding and sanding, buffing and polishing, Machining of plastics; Drilling, Tapering, Threading, Grinding, different types of welding.

PLASTIC PROCESSING TECHNIQUES – II LAB

LIST OF PRACTICALS

1. To produce small components on hand operated compression moulding machine.

2. To produce components on automatic/semi-automatic compression moulding machine.

3. To visit works of a plastics molding workshop and observe molding and to prepare a report.

4. Study and operation of Thermoforming machine.

5. Study and operation of vacuum forming machine

6. Preparation of FRP sheet by hand lay-up technique

7. Study and operation of Grinder for plastic product finishing.

8. Study and operation of Rotational Molding m/c

INSTRUCTONAL STRATEGY

Students should be trained to operate various concerned machinery regarding different plastic processes. Students should visit a plastic processing workshop for physical observation the processing unit for deep understanding of the machine and process.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Basic Engineering Handbook by Michael L Bernis
2 Process of Plastic by A.S. Athalye
3 Plastic Materials, Plastic Processing, Plastic Mould Design Volume I & II by Dr. S.K Nayak
4 Plastic Engineering Handbook (SPI), by Frados
5 Plastic materials and processes (a concise encyclopedia), by Charles Harper
6 Injection and Compression Moulding Fundamentals, by Isayev.
7 Encyclopedia of Polymer Science and Technology Vol. 1-23, by Mark &Overberger.
8 Practical Thermoforming Principles & Applications, by J. Florian
9 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	16	16
2	16	16
3	10	10
4	10	10
5	10	10
6	10	10
7	12	12
8	07	8
9	07	8
Total	**98**	**100**

5.3 Design of Dies & Mould-II

L T P
5 2 7

RATIONALE

A diploma holder in Plastic Mould Technology is engaged in manufacturing plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skills in design of moulds and dies.

Learning Outcome

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

1. Explain features of extrusion dies, their materials and design parameters.
2. Understand mechanism of heating and temperature control.
3. Explain detail of compression moulds, transfer moulds and blow moulds.

DETAILED CONTENTS

Dies

1. General features of extrusion dies (04 Periods)

2. Die materials (04 Periods)

3. Design features dies – Polymer melt flow, die geometry, material of construction, ease of maintenance and cleaning. Die land, die swell (12 Periods)

4. Heating system and temperature control (04 Periods)

5. Types of dies & their free hand drawing (12 Periods)

Bending Die, Shallow Drawing Die, Deep Drawing, simple and Progressive Die, Blanking Die, Piercing Die.

6. Dies for rod, flexible tube, wire coating (04 Periods)

Compression Mould and Transfer Moulds

7. Types of compression molds – positive, semi-positive, flash and landed positive type (10 Periods)

8. Calculation of clamp pressure, ram pressure, platen size, no. of impressions. Selection of compression molding machine (06 Periods)

9. Principles of transfer molding, pot capacity, design of sprue, runner and gates (10 Periods)

Blow Moulds

10. Materials for flow moulds (04 Periods)

11. Extrusion blow moulds – cavity and pinch off (06 Periods)

12. Injection blow moulds – neck design, mandrel design, Parisonthickness control (08 Periods)

13. Mould cooling (10 Periods)

DESIGN OF DIES AND MOULDS – II LAB

LIST OF PRACTICALS

1. Design and drawing of a single impression compression mould

2. Design and drawing of a multi-impression compression mould

3. Design and drawing of a transfer mould

4. Design and drawing of blow mould

5. Design and drawing of a die for pipe/tubing (Bending Die, Shallow Drawing Die, Deep Drawing, simple and Progressive Die, Blanking Die, Piercing Die.

Note: Minimum 10 sheets will be prepared by the students.

INSTRUCTONAL STRATEGY

Students should be taught geometrical as well as analytical aspects of mold design. Appropriate available software should also should be added.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Handbook of Mould, tool and die Repairing by S. Thompson
2 Plastic part design for Injection Moulding by Robert A. Malloy
3 Plastic Engineering by R.J. Knowford ; Maxwell Macmillan International Editions Publications
4 Injection Moulding handbook by Dominick V. Rosato
5 Mould Making Hand Book,Stoeckert.
6 Plastics Moulds and Dies,Sors.
7 Injection Moulds, V.D.I.
8 Injection Mould Design –PyeR.G.W.
9 Production Technology - Er.R.K.Jain.
10 Production Technology - P.C. Sharma Pub: S. Chand andCo.
11 Workshop Technology, Volume I & II – W.A.JChapman.
12 Elements of Workshop Technology-S.K.Hajra Choudhury &A.K Hajra Choudhury.

13 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	04	04
2	04	04
3	12	14
4	04	04
5	04	04
6	16	16
7	10	10
8	06	06
9	10	10
10	04	04
11	06	06
12	08	08
13	10	10
Total	**98**	**100**

5.4 Plastic Testing-II

L T P

4 - 4

RATIONALE

This subjects provides an idea about the properties evaluation of plastics. The different class of properties are estimated using different standard techniques for finding the suitability and importance of plastic in general and specific use.

Learning Outcome

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

1. Understand electrical, optical, chemical properties of plastics
2. Explain test methods for bio- degradability
3. Explain process of testing of plastic products

DETAILED CONTENTS

Unit – I **Electrical & Optical Properties** (14 Periods)

Dielectric strength - Dielectric constant and Dissipation factor – Insulationresistance - Volume and Surface resistivity - Arc resistance - Antistatic tests.Refractive index - Luminous transmittance - Clarity and Haze - Photo-elasticproperties - Colour measurements and Gloss.

Unit – II **Chemical Properties** (14 Periods)

Introduction – Immersion test – Stain Resistance of Plastics – Environmental Stress Cracking Resistance (ESCR).

Flammability

Introduction – Flammability Test – Ignition Properties – Oxygen Index Test – Flammability of Cellular Plastics – Smoke Density Test – UL90 Flammability Test.

Unit – III **Weathering Properties** (14 Periods)

Introduction – environmental factors affecting plastics – Acceleratedweathering tests – outdoor weathering of plastics – Resistance of plastics to biological systems.

Bio-degradability Testing

Test methods and standards for bio-degradable plastics - Criteria used in evaluation of bio-degradable plastics - Description of current test methods.

Unit – IV **Product Testing** (14 Periods)

Plastics Pipes – Films – Woven sacks – Water Tanks – Containers & Plastic Foams.

LIST OF PRACTICALS

1. Determination of Dielectric Strength of plastics
2. Determination of Haze and luminous transmittance of transparent plastics
3. Determination of Environmental Stress cracking resistance of plastic.
4. Determination of Flame resistance as per UL 94 of plastic
5. Demonstration of testing of PVC PIPE as per IS 4985:2021

*Other practicals can also be conducted based on theory.

INSTRUCTONAL STRATEGY

Instructor should focus on different engineering properties and to perform their testing for comparison with true values. The virtual laboratory help should be taken to make aware the students for different testing features.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K. Nayak
2 Plastics Testing Technology Hand Book – Shah Vishu
3 Simple Methods for Identification of Plastics – DietrichBraun
4 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	14	25
2	14	25
3	14	25
4	14	25
Total	**56**	**100**

5.5 Universal Human Values

L-T-P
2-0-1

Course Objectives

This introductory course input is intended

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

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

Course Methodology

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

The syllabus for the lectures is given below:

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

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

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

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

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

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

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

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

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

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

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

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

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

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct

3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order
    b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
    c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:

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

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

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

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

b. The teacher's manual (Latest Edition)

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

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

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.

8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Case study Hevade Bazar Movie
7. RC Shekhar , Ethical Contradiction ,Trident New Delhi
8. Gandhi A., Right Here Right Now, Cyclewala Production

SUGGESTED DISTRIBUTION OF MARKS

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

6.1 Plastic Recycling & Waste Management

L T P
6 - -

RATIONALE

This subjects provides an idea about the recyclability & value addition by plastic waste in the environment. The impact of mishandling of the waste could lead a disastrous situation in the environment. Students will get InSite of the energy addition by the plastic waste system.

Learning Outcome

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

1. Knowledge of plastic waste management techniques
2. Knowledge of machinery, value addition
3. Knowledge of environmental issue and guidelines of recycling of plastic wastes
4. Understand the environmental legislation in India

DETAILED CONTENTS

UNIT –I Plastics Wastes and its Separation (20 Periods)

Introduction – Sources of Plastics Waste – Collection of Plastics Waste – Sorting and segregation methods viz. simple identification techniques, Density Separation, Solvent Separation, floatation technique, Air classification, melt filtration and Equipment based sorting techniques.

UNIT –II Plastics Waste Management Techniques (20 Periods)

Plastics Recycling – 4 R & I approach – code of Practice – types ofRecycling viz. Primary, Secondary, Tertiary and quaternary techniques with examples – Fuel from Plastics Waste - Energy recovery from Plastic Waste – Co-processing in cement kiln
Plastic Waste in Road Construction.

UNIT –III Machinery and Value addition (24 Periods)

Process flow chart by mechanical route - Basic Mechanical recycling Plant – Additives for improving quality of recycled products – value addition in Plastics recycling viz., PP/HDPE woven sacks to Pots, PE/PE multilayer film waste to moulded products.

UNIT – IV Plastics Waste and Environment (20 Periods)

Environmental issues and Guidelines for Recycling of Plastics Wastes – Environmental legislation in India.

INSTRUCTONAL STRATEGY

Main focus of this subject must be plastic waste management and separation techniques. Teachers should visit a plastic waste management plant with students to workshop for physical observation and value addition by plastic waste.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests

RECOMMENDED BOOKS

1 Technical Manual on Plastics Processing –
2 Recycling & Plastics Waste Management – Dr. J S Anand
3 Environmental Engineering & Management – Suresh k. Dameja
4 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	20	23
2	20	23
3	24	31
4	20	23
Total	**84**	**100**

6.2 METROLOGY AND MEASURING INSTRUMENTS

L	T	P
7	-	4

RATIONALE

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

LEARNING OUTCOME

After undergoing the subject, students will be able to :

- use vernier calliper, micrometer, Height gauge for linear internal and external measurement.
- use bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.
- use bevel protector, sine bar, slip gauge, dial indictor, angle deckor, poppy dial for angular measurements.
- measure spur gear characteristics using gear tooth vernier, outside diameter over dovel pins.
- use tool makers microscope
- measure surface roughness parameters.
- use profile projector, auto collimeter, angle deckor.
- select and measure variables using electrical and electronics comparators and measuring instrument, sensors, transducers.
- select and use non destructive testing methods.
- explain the use of coordinate measuring machine.
- use the concept of limits, fits and tolerance in assembly of components

DETAILED CONTENTS

1. Introduction (08 Periods)

   1.1 Definition of metrology
   1.2 Standard of measurement
   1.3 Types of Errors - Controllable and random errors
   1.4 Precision, accuracy, sensitivity, hysteresis, response time, repeatability, calibration, uncertainty of measurement, interchangeability.
   1.5 Standardization and standardizing organizations

2. Linear and Angular Measurement (20 Periods)

2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.

2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.

2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.

2.4 Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and squareness

2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic .

2.6. Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.

3. Measurement of Surface Finish (12 Periods)

3.1 Terminology of surface roughness.

3.2 Concept of primary texture and secondary texture.

3.3 Factors affecting surface finish.

3.4 CLA, RMS and RA value.

3.5 Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf.

4. Limits, Fits and Tolerance (05 Period)

5. Measurements of Screw threads and Gauges (10 Periods)

5.1 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.

5.2 Measurements of gears (spur) – Measurement of tooth thickness, pitch, Gear Ball tester, Lead and Profile Testers.

5.3 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.

6. Instrumentation (15 Periods)

6.1 Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers.

6.2 Strain gauge – use of strain gauge and load cells

6.3 Various types of temperature measuring instruments such as thermometers, Thermistor, Bimetallic strip, Pyrometers

Note: There should be a visit to established metrology lab to familiarize students with purpose and need of metrology.

LIST OF PRACTICALS

1. Internal and external measurements with vernier calliper and micrometer
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
   i) Cylindrical rollers and spherical balls and slip gauges
   ii) Bevel protector
   iii) Sine Bar/Sine Table , Slip Gauges, Height Gauge and dial indicator.
   iv) Angle deckor.
7. Measurement of thread parameters by using tool maker's microscope.
8. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
9. Measurement of surface roughness using surface roughness tester.
10. Measurement of a profile using profile projector.
11. Study and use of Auto-Collimator.
12. Determination of temperature of thermocouple, pyrometer, Infrared thermometer.

INSTRUCTIONAL STRATEGY

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Website for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	12
2	20	28
3	12	18
4	05	08
5	10	14
6	15	20
Total	**70**	**100**

6.3 COMPUTER AIDED MOULD DESIGN LAB

L T P
- - 14

RATIONALE

This subject will equip students with computer based design knowledge of die and mold for plastic processing. In this practical subject, the students are required to learn the basics of software such as Mechanical Desktop, Mould Creator, Mould Flow etc. and further to design at least 2 moulds for given components using these software.

LEARNING OUTCOME

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

1. To design hand injection mould
2. To design mould elements
3. To design Single impression Two plate mould
4. To design Multi Impression Two plate mould
5. To design Three plate mould (Multi Impression)
6. To design Split Mould .
7. Mould design for integrated undercuts

DETAILED CONTENTS

1. Starting up, practice on – how to create a new drawing file, setting drawing limits and saving a file, drawing lines in different ways using absolute co-ordinates, user co-ordinates, WCS, UCS, drawing lines, circles, arcs, ellipses, polygons, splines, polylines, zoom commands.

2. Practice on Edit commands such as erase, copy, mirror, array, offset, rotate, oops, undo, redo, scale, stretch, trim, break, extend, chamfer, fillet

3. Practice on text commands, single line text, paragraph text, editing text, text size, text styles, changing properties commands

4. Practice on layer commands, creating layer, freeze, layer on/off colour assigning, making a layer, current layer, load line type, lock and unlock layer, move from one layer to other.

5. Practice on Hatching-Hatch pattern selection

6. Practice on dimensioning – linear dimensioning, angular dimensioning radius/diameter dimensioning, O-snap command, aligned dimensioning, editing of dimensioning, tolerances in dimensioning

7. Blocks and X-refs - How to make a block, how to insert a block, using block in any drawing, working with x-refs, x-ref options

8. Practice on print/plot commands. Export/import commands

9. Practice on making complete drawings of components by doing exercises

10. 3D view point, resin, 3d modeling; wire frame, solids, surface modeling; evaluation command, creating surfaces, union, substraction, extrude commands; 3D array, mirror, rotate, align etc.

List of Practical's

1. To design hand injection mould
2. To design mould elements
3. To design Single impression Two plate mould
4. To design Multi Impression Two plate mould
5. To design Three plate mould (Multi Impression)
6. To design Split Mould.
7. Mould design for integrated undercuts

INSTRUCTIONAL STRATEGY

Stress should be given on the practical application of AutoCAD on mould design therefore students should be asked to design sample mould in AutoCAD.

RECOMMENDED BOOKS

1. AutoCad by RW Leigh, Galgotia, N.D.
2. Engineering Drawing with AutoCAD 2000 by T. Jaypooran, Vikas Publishing House
3. Auto CAD – 2004, Umesh Shethigan, Abdul Khader, Janatha Publishers
4. Auto CAD reference manuals by Autodek
5. Mastering CAD/CAM by Ibrahim Zeid
6. Computer Aided Analysis and design by Srinivasa Praksh Regalla

6.4 PROJECT WORK

L	T	P
-	-	12

RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the project work, students will be able to:
Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute-based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

General Guidelines

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and Environmental pollution control.

Part-A
Choose any one problem of Mould for any type of plastic products used in daily life in commercial or domestic.

PART-B:
The student will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygienic conditions, Education facilities and various Programmes/ projects running for the development and the personnel's and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbances and will make a mention of that in his report with its reason, suggesting remedies or ways to minimize it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution Control as advised by the guiding teacher.

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Equipment requirement:

Following Laboratories are required for Diploma Programme in Plastic Mould Technology:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Applied Mechanics
- Basics of Information Technology/Computer Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Electrical Shop
- Smithy Shop
- Fitting and Plumbing Shop
- Sheet Metal Shop
- Welding Shop
- Foundry Shop
- Machine Shop
- Material and Metallurgy Laboratory
- Mechanical Engineering Drawing
- Strength of Material Laboratory
- Electrical and Electronics Engineering Laboratory
- Mechanical Workshop
- Hydraulic and Pneumatic Laboratory
- Thermal Engineering Laboratory
- Metrology Laboratory
- Refrigeration and Air Conditioning Laboratory
- Theory of Machine Laboratory
- Automobile Engineering Lab
- Environmental Engineering Lab
- Energy Conservation Lab
- Computer Aided Mould Design Lab

LIST OF EQUIPMENTS FOR DIPLOMA IN PLASTIC MOULD TECHNOLOGY

Sr. No.	Description	Qty	Total Price (Rs)
COMMUNICATION LABORATORY			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500
APPLIED PHYSICS LABORATORY			
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil weston-type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000

Sr. No.	Description	Qty	Total Price (Rs)
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000
APPLIED CHEMISTRY LABORATORY			
1.	Digital Balance	1	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000
8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Able's Flash Point apparatus	2	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000
14.	Decicators	06	8,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	2,000

Sr. No.	Description	Qty	Total Price (Rs)
16.	Chemicals - EDTA-1 kg - Eriochrome Black-T(solochrome black T)-200g - Buffer solution (NH_3 - 2.5 ltr, NH_4Cl – 1 kg) - Zinc sulphate- 500g - H_2SO_4- 2.5 ltr - Phenolphthalein indicator (as per requirement) - Methyl orange indicator (as per requirement) - Charcoal (as per requirement) - Kerosene- 1 ltr	LS	20,000
17.	Miscellaneous	LS	2,000
ENGINEERING DRAWING			
1.	Drawing Boards (700 x 500mm)	60	25,000
2.	Draughtsman Tables	60	1,80,000
3.	Draughtsman Stools	60	40,000
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Model of different wooder joints	1	1,000
6.	Model of different screw threads	1	1,000
7.	Model of various locking devices	1	1,000
8.	Model of various joints	1	1,000
9.	Cut section Model of various couplings	1	3,000
10.	Miscellaneous	LS	5,000
APPLIED MECHANICS LABORATORY			
1.	Polygon law of forces apparatus	1	2,000
2.	Jib crane	1	4,000
3.	Apparatus for reaction at supports	1	5,000
4.	Inclined plane and friction apparatus	1	2,500
5.	Screw jack	1	1,000
6.	Worm and worm wheel	1	3,500
7.	Single Purchase Winch Crab	1	4,000
8.	Miscellaneous	LS	1,000
BASICS OF IT LABORATORY/COMPUTER LABORATORY			
1.	Computer System with latest configuration	30	8,00,000
2	Printer (MFP)	1	25,000
3	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitiser	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000

Sr. No.	Description	Qty	Total Price (Rs)
8.	AutoCAD/Solid Works/Unigraphics/Pro-C (any one software)	30 user	5,00, 000
9.	LCD Projector	1	35,000
10.	UPS	60	1,20,000
11.	Software (latest windows, latest MS Office)	1	1,00,000
12.	Scanner	1	10,000
13.	Miscellaneous	LS	5,000
CARPENTRY SHOP			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500
PAINTING AND POLISHING SHOP			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
ELECTRICAL SHOP			
1.	Tool kit (Plier, Srew driver, Knife, Steel rule, hammer, sciber, pincer steel tape etc.)	20	20,000
2.	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.(as per requirement)		8,000
3.	Electric Iron	1	1,500
4.	Electric kettle	1	1,500
5.	Ceiling fan/table fan	1	2,500
6.	Desert cooler	1	5,000
7.	Lead acid battery	2	8,000
8.	Battery Charger	1	6,000
9.	Miscellaneous		3,000

Sr. No.	Description	Qty	Total Price (Rs)
SMITHY SHOP			
1.	Black smithy forge (with open hearths, accessories to match the forge)	20	40,000
2.	Wrought iron anvils	20	20,000
3.	Swage blocks	4	8,000
4.	Blower with accessories, motor switch etc	1	6,000
5.	Work benches with vices	2	6,000
6.	Power hammer	1	20,000
7.	Tools and accessories – hammers, swages, tongs, pokers, pullers etc	20	10,000
8.	Miscellaneous	LS	1,500
FITTING AND PLUMBING SHOP			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribers	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chiesels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500
SHEET METAL			
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00

Sr. No.	Description	Qty	Total Price (Rs)
4.	Shearing Machine	1	20,000
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminium)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00
10.	Miscellaneous	LS	1,000
WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000
16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000

FOUNDRY SHOP			
1.	Moulding boxes	**40**	8,000
2.	Ladles	**5**	2,000
3.	Tool Kits	**10 set**	5,000
4.	Quenching tanks	**2**	5,000
5.	Portable grinder	**1**	3,000
6.	Pit furnace with blower	**1**	10,000
7.	Miscellaneous	LS	1,000
MACHINE SHOP			
1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000
6.	Work bench	3	10,000
7.	Precision instruments	1	10,000
8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	Miscellaneous	LS	5,000
MATERIALS AND METALLURGY LABORATORY			
1.	Electric furnace muffle type	1	60,000
2.	Forced circulation tempering furnace	1	30,000
3	Quenching tank	2	5,000
4.	Grinder	2	4,000
5.	Pyrometers	1	10,000
6	Specimen Kit (Ferrous and Non-ferrous Metals (25 Nos)	1	5,000
7.	Metallurgical microscope	3	35,000 each
8	Abrasive cut off machine	1	50,000
9	Specimen Polishing Machine	1	50,000
10	Thermocouples	2	5,000
11	Set of Specimen of different alloys	1	5,000
12	Brinnel Hardness Tester	1	80,000

HYDRAULICS & PNEUMATIC LABORATORY			
1.	Piezometer tube	2	100
2.	U tube differential manometer	2	2,000
3.	Bourdon's Tube pressure gauge	1	1,000
5.	Hydraulic jack	1	4,000
6.	Hydraulic press Working Model	1	5,000
7.	Bernoulli's apparatus	1	15,000
8.	Venturimeter apparatus with differential manometer	1	10,000
9.	Pipe friction apparatus	1	15,000
10.	Reciprocating pump- Cut Section Model	1	20,000
11.	Centrifugal pump	1	25,000
12	Working Model of Pelton Wheel Turbine	1	20,000
13	Working Model of Francis Turbine	1	20,000
14	Working Model of Kaplan Turbine	1	20,000
15	Hydraulic Circuit Trainer Kit	1	50,000
16	Pneumatic Circuit Trainer Kit	1	50,000
17	Working Model of Hydraulic Brake system	1	50,000
18	Working Model of Hydraulic Ram	1	5,000
METROLOGY LABORATORY			
1.	Digital vernier calliper	3	5,000
2.	Digital micrometer	3	5,000
3.	Height gauge	2	1,500
4.	Depth gauge	2	1,000
5.	Combination set	1	1,000
6.	Bevel protractor	1	1,000
7.	Sine bar	1	1,000
8.	Precision balls and rollers	1	500
9.	Surface plate	2	15,000
10.	Slip gauges set	1	10,000
11.	Comparator – Mechanical , Pneumatic	2	40,000
12.	Gear tooth vernier	1	2,000
13.	Snap and ring gauges	1	1,500
14.	Feeler gauge, radius gauge	1	1,000

15.	Angle plate	1	1,000
16.	Tool makers microscope	1	40,000
17.	Profile projector	1	75,000
18.	Surface roughness tester	1	60,000

PLASTIC PROCESSING LAB-I & II

Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
1.	Hand injection moulding Machine With heaters and(15gm/20gm./25gm.) Temp. controllers.	3	30000
2.	Hand blow moulding machine (15gm./30gm.) 2 Nos. each	4	40000
3.	Semi-automatic moulding Blow moulding machine(15gm.)	1	150000
4.	Hand compression moulding	1	60000
5.	Automatic compression Moulding machine-(30ton)	1	300000
6.	Vacuum forming m/c (smallest size)single chamber	1	200000
7.	Scrap grinding m/c(small)	1	50000
8.	PVC Welding m/c/hot welding Machine	2	20000
9.	Different moulds for all Machines.	-	20000/moulds.
10	Extruder machine(one inch)	1	10000000
11	gravure printing m/c	1	200000
12	Pad printing m/c	1	50000

PLASTIC TESTING LAB

Sr. No.	Description	Qty	Total Price (Rs)
1.	Restivity test equipment	1	70000
2.	U.T.M m/c(2ton)	1	150000
3.	Impact testing machine	1	40000
4.	Hardness testing machine	1	20000
5.	film dart Impact testing machine	1	25000
6.	Melt flow machine	1	200000
7.	HDT machine	1	100000
8.	Software's as per requirements	one	500000

ENVIRONMENT ENGINEERING LABORATORY			
1.	pH Meter	01	500
2.	Turbidity Meter	01	5000
3.	Oven with Temperature Controller and Forced Air Circulation Type	01	20000
4.	B.O.D. Incubator	01	25000
5.	Water Analysis Kit	01	5000
6.	High Volume Sampler	01	40000
7.	Electrical Balance for weighing upto 1/10 of milligram (capacity)	01	1000

ENERGY CONSERVATION LABORATORY			
1	Clamp meter	02	5000
2	Multimeter	02	2000
3	Power Analyser	01	20000
4	Different types of lamps (LS) – 60 W lamp, 230 V , 100 V – 200 W lamp – 500 W lamp – 100 W lamp, 110 V, 150 V	10	500
5	Lux meter	02	5000
6	Centrifugal pump, 1 kW	1	15,000
7	Standard window A.C.	01	20000
8	Anemometer	02	5000
9	Thermometer	03	2000
10	Flow meter	02	10000
11	Pumping set with at least two pumps of different capacity.	1 set	10000
12	Pressure gauge fitted on discharge lines	1 set	2000
13	Variable Frequency Drive	02	50000

14	A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switch.	1	3000
15	Stop watch	2	1000
16	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	1	10000
17	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25000

Computer Aided Mould Design Lab Equipment			
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
1.	Open Source/Freeware Software for Mould Design	-	-
2.	Computer System (Intel i5/AMD Ryzen 5 latest generation or higher, 8GB RAM, 1TB HDD or 512 SSD, 19.5 Inch Monitor, Window 10 pro or latest)	10	6,50,000/-
3.	Printer (All in one Ink Tank Printer -01 No., All in One laser Printer-01 No.)	02	60,000/-
4.	Anti Virus (3 Years License)	10	25,000/-
5.	Online UPS(5KVA) with Battery and stand Warranty on UPS: 03 Years, Warranty on Batteries: 02 Years)	01	1,25,000/-

Note:

1. The specifications and price of equipment mentioned above used as broad guidelines for purchase of equipment.
2. Any other items not mentioned in the lit of equipment can be purchased as provision has been made for purchase under the item miscellaneous for each lab/shop.
3. Any additional equipment, already available in the institute, may be used for demonstration to the students.

NOTE:

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

(C) Furniture Requirement

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

10.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects

may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication

skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feed back to every student

8. The student centred activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

13. LIST OF PARTICIPANTS

The following experts have participated in workshop for Developing Curriculum Contents of Diploma course in Plastic Mould Technology for UP State on 10th January 2020, 08th January, 2021, 11th-12th January, 2021, 01st – 02nd July, 2021 at IRDT Kanpur:

1. Sh. R.C. Soni, HOD, Mechanical Engineering, Government Polytechnic Kanpur.
2. Sh. S.P. Pal, HOD, Rubber & Plastic, Government Polytechnic Budaun.
3. Sh. Durgesh Chandra, HOD, Chemical Engineering, Government Polytechnic Firozabad.
4. Sh. Pankaj Singh, Lecturer, Mechanical Engineering, Government Polytechnic Kanpur.
5. Sh. Gaurav Kishor Kanaujiya, Assistant Professor, IRDT Kanpur- Coordinator, IRDT Kanpur

Curriculum Design by

IRDT U.P. Kanpur

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