NSQF ALIGNED
CURRICULUM FOR FOUR YEARS DIPLOMA IN

TOOL & MOULD MAKING

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Annual System

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(Effective from Session -2023-24)

Prepared by:

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Curriculum Development Cell

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INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING U. P. KANPUR-208002

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PREFACE

An important issue generally debated amongst the planners and educator'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 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 of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Director
Institute of Research Development &Training
Uttar Pradesh
Kanpur

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4. Secretary, Board of Technical Education, U.P., for showing keen interest in this project of reviewing the curriculum.
5. All the participants from industry/field organizations, engineering colleges, polytechnics, and other technical institutions for their professional inputs during curriculum workshops.
6. Faculty /Subject Experts from different department of U.P Government Polytechnics for content updating .

Coordinator,
Institute of Research Development &Training,
U. P. Kanpur

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN TOOL & MOULD MAKING

1)	Name of the Programme	:	Diploma Programme in Tool & Mould Making
2)	Duration of the Programme	:	Four Year (Annual System)
3)	Entry Qualification	:	Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4)	Intake	:	60
5)	Pattern of the Programme	:	Annual Pattern
6)	NSQF Level	:	Level - 5
7)	Ratio between theory and Practice	:	35:65 (Approx.)

2- EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN TOOL & MOULD MAKING

The Institute of Tool Room Training UP, Lucknow was established by the Department of Infrastructure and Industrial Development, Govt. of Uttar Pradesh with the technical support of Federal Republic of Germany and Government of India in 1981. It is registered under the society act 1860 and is a premier organization approved by AICTE and Department of Technical Education, Uttar Pradesh, imparting technical education in tool room technologies.

The Tool Room is said to be the brain of industries. Tool Room is essential for industrial development. Basically, Tool room develops the brain of technocrats who think and generate innovative ideas and convert them into reality in such a way that fulfills the requirements and necessity of the various industries.

There are so many small scale industries in U.P. and surrounding states which are producing medium quality products due to unavailability of Tool Room facility in entire region. ITTUP is only one such type of institute in the state which have been actively providing latest technology and trained technical manpower to the industries for last three decades.

The diploma course "Tool & mould Making" being run by Institute of Tool Room Training UP,provide indepth knowledge of manufactuing / production of Press tool, moulds, tools, jigs and fixtures along with operations of tool room machines.Trainees get in hand practice of operations of general and special purpose machines like lathe, Milling, Grinding and CNC machine wich enable them to start working from the very first day of their jon in industry.

After completing the diplma course,trainees get placed in companies like Hawells Electricals, Tata Motors, Hero, Honda, Wipe, Bajaj Motors, JBM, M Inda Tools, Eicher Motors, Bosch, Danso India,Gmax Auto,Roop Polymers,Wohlers,Siemens India,PTC India and other reputed Mechanical and Production companies.

Some of the trainees have stablished their own industry thus providing job opportunities to the freshers and making lives better.

3- LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN TOOL & MOULD MAKING

Sr. No.	Learning Outcomes
After due completion of the course, a Diploma Programme in Tool & Mould making will be able to:	
1.	Understand the importance of effective communication.
2.	Understand the Binomial theorem to solve engineering problems Apply determinants properties and Crammer's rule to solve engineering problems
3.	Analyze different types of forces acting on a body and draw free body diagrams
4.	Explain the arrangement of atoms in various crystals. Carryout various heat treatment processes.
5.	Knowledge of various joints and joining processes such as welding, soldering and brazing.
6.	Uses of Vernier calliper, micrometer, Height gauge for linear internal and external measurement. Uses of bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.
7.	Determination of voltage-current relationship in a DC circuit under specific physical conditions
8.	Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
9.	Calculate stresses in bars of various cross-section. calculate energy stored by materials subjected to axial loads
10.	understand matrix operations and uses of matrix in different problems
11.	Detailed knowledge of various gauges , press tools, Dies and Moulds etc.
12.	Use of different types of precision instruments and Machines for production in an industry .
13.	Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check use of internet
14.	Quality control further checks the production of inferior products and wastages thereby bringing down the cost of production considerably
15.	Understand the maintenance activity and its importance of maintenance department
16.	use industrial engineering concepts to improve productivity
17.	Understanding production planning: Students will grasp the concepts and principles of production planning, including capacity utilization, scheduling, and sequencing of operations
18.	Explain the principles of management including its functions in an organisation
19.	Identify the role of non-conventional energy resources in environmental protection

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 Area/Subject
1.	Understand the importance of effective communication.	-Professional Communication
2.	Understand the engineering mathematics concepts to solve engineering problems	-Engineering Mathematics-I, II
3.	Analyze different types of forces acting on a body and draw free body diagrams	-Applied Mechanics
4.	Understand salient engineering properties of various materials (Metal & Non metal) and study of heat treatment processes.	-Mechanical Engineering Materials
5.	Knowledge of various joints and joining processes such as welding, soldering and brazing.	-Engineering Technology & Calculations
6.	Uses of Vernier calliper, micrometer, Height gauge for linear internal and external measurement. Uses of bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.	-Measurements & Metrology-I ,II
7.	Determination of voltage-current relationship in a DC circuit under specific physical conditions	-Electrical & Electronics Engineering
8.	Identify and use of different grades of pencils and other drafting instruments which are used in engineering field	-Engineering Drawing-I, II
9.	Calculate stresses in bars of various cross-section. calculate energy stored by materials subjected to axial loads	-Mechanics Of Solids
10.	understand matrix operations and uses of matrix in different problems	-Tool Materials & Heat Treatment
11.	Detailed knowledge of Manufacturing Technologies of Process involving Jig & fixtures , mould tools & die sets e.g., sheet metal pressing , plastic moulding, diecasting and forging.	-Tool Engineering –I, II, III, IV
12.	Understand the operation of various precision machine involved in Manufacturing of TOOLS and MOULDS making	-Precision Machine
13.	Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check	-Basics Of Information Technology*
14.	Quality control further checks the production of inferior products and wastages thereby bringing down the cost of production considerably	-Quality Control
15.	Understand the maintenance activity and its importance of maintenance department	-Plant Maintenance & Safety Engineering
16.	Use industrial engineering concepts to improve productivity	-Industrial Engineering

17.	Understanding production planning: Students will grasp the concepts and principles of production planning, including capacity utilization, scheduling, and sequencing of operations	-Production Planning, Estimation & Costing
18.	Explain the principles of management including its functions in an organisation	-Entrepreneurship & Management
19.	Identify the role of non-conventional energy resources in environmental protection	-Environmental Studies*

5- ABSTRACT OF CURRICULUM AREAS

1. FIRST YEAR

1.01 Professional Communication
1.02 Engineering Mathematics-I
1.03 Applied Mechanics
1.04 Mechanical Engineering Materials
1.05 Engineering Technology & Calculations
1.06 Measurements & Metrology-I
1.07 Electrical & Electronics Engineering
1.08 Engineering Drawing-I
1.09 Workshop Practice-I

2. SECOND YEAR

2.01 Mechanics of Solids
2.02 Engineering Mathematics-II
2.03 Tools Materials & Heat Treatment
2.04 Tool Engineering-I
2.05 Tool Engineering-II
2.06 Measurements & Metrology-II
2.07 Precision Machines
2.08 Engineering Drawing-I
2.09 Basics of information Technology
2.10 Workshop Practice-II

3. THIRD YEAR

3.01 Tool Engineering-III
3.02 Tool Engineering-IV
3.03 Quality Control
3.04 Plant Maintenance & Safety Engineering
3.05 Industrial Engineering
3.06 Production Planning, Estimation & Costing
3.07 Entrepreneurship & Management
3.08 Environmental Studies
3.09 Workshop Practice-III
3.10 Industrial Training-I

4. FINAL YEAR

4.01 Seminar (Group Discussions, Presentations & Evaluation)
4.02 Workshop Practice-IV (Practical skill attainments through Manufacturing of Tools)
4.03 Industrial Training-II

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6 -HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in periods per weeks in Various Years			
		I	II	III	IV
1.	Professional Communication	2	-	-	-
2.	Engineering Mathematics-I, II	4	4	-	-
3.	Applied Mechanics	3	-	-	-
4.	Mechanical Engineering Materials	3	-	-	-
5.	Engineering Technology & Calculations	3	-	-	-
6.	Measurements & Metrology-I ,II	2	2	-	-
7.	Electrical & Electronics Engineering	3	-	-	-
8.	Engineering Drawing-I, II	4	4	-	-
9.	Mechanics Of Solids	-	3	-	-
10.	Tool Materials & Heat Treatment	-	3	-	-
11.	Tool Engineering –I,	-	3	-	-
12.	Tool Engineering -II	-	3	-	-
13.	Precision Machine	-	2	-	-
14.	Basics Of Information Technology*	-	4	-	-
15.	Tool Engineering -III	-	-	3	-
16.	Tool Engineering -IV	-	-	3	-
17.	Quality Control	-	-	3	-
18.	Plant Maintenance & Safety Engineering	-	-	3	-
19.	Industrial Engineering	-	-	3	-
20.	Production Planning, Estimation & Costing	-	-	3	-
21.	Entrepreneurship & Management	-	-	3	-
22.	Environmental Studies*	-	-	2	-
23.	Seminar	-	-	-	2
24.	Workshop Practice-I, II, III, IV	22	18	23	44
	# Student Centred Activities(SCA)	2	2	2	2
	Total	**48**	**48**	**48**	**48**

7- STUDY AND EVALUATION SCHEME FOR 4 YEAR DIPLOMA PROGRAMME IN TOOL & MOULD MAKING

FIRST YEAR

Sr. No.	SUBJECTS	STUDY SCHEME Periods/ Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External Assessment
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
1.01	Professional Communication	2	-	-	-	20	-	20	50	2.5	-	-	50	70
1.02	Engineering Mathematics-I	3	1	-	-	20	-	20	50	2.5	-	-	50	70
1.03	Applied Mechanics	3	-	-	-	20	-	20	50	2.5	-	-	50	70
1.04	Mechanical Engineering Materials	3	-	-	-	20	-	20	50	2.5	-	-	50	70
1.05	Engineering Technology & Calculations	3	-	-	-	20	-	20	50	2.5	-	-	50	70
1.06	Measurements & Metrology-I	2	-	-	-	20	-	20	50	2.5	-	-	50	70
1.07	Electrical & Electronics Engineering	3	-		-	20	-	20	50	2.5	-	-	50	70
1.08	Engineering Drawing-I	2	-	2	-	20	-	20	50	3.0	-	-	50	70
1.09	Workshop Practice-I	-	-	22	-	-	300	300	-	-	450	-	450	750
# Student Centred Activities(SCA)		-	-	2		-	30	30	-	-	-	-	-	30
TOTAL		**21**	**1**	**26**	**-**	**160**	**330**	**490**	**400**	**-**	**450**		**850**	**1340**

#Student Centred Activities(SCA) 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.

* Common with other Engineering Diploma Course.

SECOND YEAR

Sr. No	SUBJECTS	STUDY SCHEME Periods/ Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External Assessment
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
2.01	Mechanics Of Solids	3	-	-	-	20	-	20	50	2.5	-	-	50	70
2.02	Engineering Mathematics-II	3	1	-	-	20	-	20	50	2.5	-	-	50	70
2.03	Tool Materials & Heat Treatment	3	-	-	-	20	-	20	50	2.5	-	-	50	70
2.04	Tool Engineering -I	3	-	-	-	20	-	20	50	2.5	-	-	50	70
2.05	Tool Engineering -II	3	-	-	-	20	-	20	50	2.5	-	-	50	70
2.06	Measurements & Metrology-II	2	-	-	-	20	-	20	50	2.5	-	-	50	70
2.07	Precision Machine	2	-	-	-	20	-	20	50	2.5	-	-	50	70
2.08	Engineering Drawing-II	2	-	2	-	20	-	20	50	3.0	-	-	50	70
2.09	*Basics Of Information Technology	-	-	4	-	-	40	40	-	-	60	3	60	100
2.10	Workshop Practice-II	-	-	18	-	-	300	300	-	-	450	-	450	750
	# Student Centred Activities(SCA)	-	-	2	-	-	30	30	-	-	-	-	-	30
TOTAL		**21**	**1**	**26**	**-**	**160**	**370**	**530**	**400**	**-**	**510**	**-**	**910**	**1440**

* Common with other Engineering. Diploma Course.

Student Centred Activities(SCA) 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.

* Common with other Engineering Diploma Course.

THIRD YEAR

Sr. No	SUBJECTS	STUDY SCHEME Periods/ Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External Assessment
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
3.01	Tool Engineering -III	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.02	Tool Engineering -IV	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.03	Quality Control	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.04	Plant Maintenance & Safety Engineering	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.05	Industrial Engineering	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.06	Production Planning, Estimation & Costing	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.07	Entrepreneurship & Management	3	-	-	-	20	-	20	50	2.5	-	-	50	70
3.08	*Environmental Studies	2	-	2	-	20	10	30	50	2.5	20	3	70	100
3.09	Workshop Practice-III	-	-	24	-	-	300	300	-	-	450	-	450	750
3.10	Industrial Training-I	-	-	-	-	-	30	30	-	-	-	-	-	30
# Student Centred Activities(SCA)		-	-	2	-	-	30	30	-	-	-	-	-	30
TOTAL		**23**	**-**	**28**	**-**	**160**	**370**	**530**	**400**	**-**	**470**	**-**	**870**	**1400**

Student Centred Activities(SCA) 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.

* Common with other engineering Diploma Course.

STUDY AND EVALUATION SCHEME FOR 4 YEAR DIPLOMA PROGRAMME IN TOOL & MOULD MAKING

FOURTH YEAR

Sr. No	SUBJECTS	STUDY SCHEME Periods/ Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External Assessment
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.01	Seminar	-	2	-	-	-	50	50	-	-	100	-	100	150
4.02	Workshop Practice-IV	-	-	44	-	-	300	300	-	-	450	-	450	750
4.03	Industrial Training-IV	-	-	-	-	-	20	20	-	-	50	3	50	70
# Student Centred Activities(SCA)		-	-	2	-	-	30	30	-	-	-	-	-	30
TOTAL		-	**2**	**46**	**-**	**-**	**400**	**400**	**-**	**-**	**600**	**-**	**600**	**1000**

NOTE:-

1- Each period will be of 50 minutes duration
2- Each session will be of 32 weeks.
3- Effecting teaching will be at least 25 weeks.
4- Remaining periods will be utilised for revision etc
5- After the Annual Exam, Student of **II and III year** will go for a 4/6 week training in an industry. It will be structured and supervised by the institution. Purpose of the visit is to give students an **exposé** of industrial setup and that of simple tools, instruments and the skill there in day to day use. Every student will submit the institution a report of his visit. The report will invariably contain the description of his observations about (1) Product/work (2) Processes involved (3) Tools and equipments used. He will be evaluated at the institution Level under SCA for the report presented.
6- Workshop Practical- Trainees has to work 7 Hrs per day with 30 minutes break after 4 Hrs to complete the job for the day of workshop.
7- # Student Centred Activities(SCA) 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- * Common with other engineering Diploma Course.

FINAL MERIT FOR THE AWARD OF 4 YEAR DIPLOMA IN "TOOL AND MOULD MAKING"

1.	30% OF I YEAR MARKS	402.00
2.	50% OF II YEAR MARKS	720.00
3.	70% OF III YEAR MARKS	980.00
4.	100% OF FINAL YEAR MARKS	1000.00
AGGREGATE MARKS	- TOTAL -	3102.00

GRADATION

80% & ABOVE MARKS IN AGGREGATE	- PASS WITH HONOURS
FROM 66% TO BELOW 80% MARKS IN AGGREGATE	- I DIVISION
FROM 45% TO BELOW 66% MARKS IN AGGREGATE	- II DIVISION

NOTE: -

1. Candidates have to secure pass marks in theory, Practicals & Sessional separately.
2. In theory examination passing marks are 33%,in sessional Passing marks are 50% and in practical examination, passing marks are 40% but in aggregate minimum 45% marks are required to pass the examination.

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

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

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

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

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

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

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

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

PROFESSIONAL COMMUNICATION

Subject Code: 1.01

L	T	P
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

1. PART I : COMMUNICATION IN ENGLISH (35 Lectures)

1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- E-mail, video conferencing, Telephonic or latest means etc.

1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Letters : Kinds of letters:-
Official, semi-official, unofficial, for reply or in reply, Circulars, News Letters.

1.3.2 Report writing and Note making.

1.3.3 Internal and external communication.
Internal-Circulers, News letters, Notices
External- Press Release, Advertisement, Media Briefings

1.4 Grammar : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.

1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II : COMMUNICATION IN HINDI (15 Lectures)

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.
2.2 Development of expression through ; Letter writing in Hindi:
Kinds of letters:- Official, semi-official, unofficial , for reply or in reply, Circulars, News Letter.
.
(1) Paper should be in two parts, part I - English and part II- Hindi.

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; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

Websites for Reference:

1. http://www.mindtools.com/
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	60
2	15	40
Total	**50**	**100**

ENGINEERING MATHEMATICS I

Sub Code :-1.02

L	T	P
3	1	-

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 : (15 Lectures)

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

1.4 Vector algebra : Dot and Cross product, Scalar and vector triple product. Application to work done, Moment of a force, Plane geometry.

2. TRIGONOMETRY : (15 Lectures)

2.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.

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

3. CO-ORDINATE GEOMETRY : (12 Lectures)

3.1 Standard form of curves and their simple properties -

`Parabola, Ellipse, Hyperbola, Tangent and Normals

3.2 Straight lines, planes and spheres in space - Distance between two points in space, Direction cosign and direction ratios, Finding equation of a straight line, and shortest distance between two lines Under different conditions equation of a plane, relation between lines and planes, sphere.

4. DIFFERENTIAL CALCULUS - I : (15 Lectures)

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, - Function of a function, Logarithmic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.
4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse and circular function), Definition, Graphs, range and Domain and Derivations of each of these functions.

4.4 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

5. INTEGRAL CALCULUS - I : (18 Lectures)

5.1 Methods of Indefinite Integration :- Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.

5.2 Meaning and properties of definite integrals, Evaluation of definite integrals.

5.3 Application : Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.

5.4 Simpsons and Trapezoidal Rule : their application in simple cases, Concept of error for simple function.

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

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 No.	Time Allotted (Periods)	Marks Allotted (%)
1	15	15
2	15	15
3	12	20
4	15	20
5	18	30
Total	**75**	**100**

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APPLIED MECHANICS

Sub. Code:-1.03

L	T	P
3	-	-

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, couples, General condition of equilibrium, friction, 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.
- Analyzing various types of stress, strain
- Analysis of shell

DETAILED CONTENTS

1. **INTRODUCTION:** **(06 Lectures)**

Mechanics and its utility. Concept of scalar and vector quantities. Effect of a force. Tension & compression. Rigid body. Principle of physical independence of force. Principle of transmissibility of a force.

2. **SYSTEM OF FORCES** : **(12 Lectures)**

Concept of coplanar and non-coplanar forces including parallel forces. Concurrent and non-concurrent forces. Resultant force. Equilibrium of forces. Law of parallelogram of forces. Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a particle, conditions of equilibrium of coplanar concurrent force system.

3. **MOMENT & COUPLE:** **(10 Lectures)**

Concept of Varignon's theorem. Generalized theorem of moments. Application to simple problems on levers-Bell crank lever, compound lever, steel yard, beams and wheels, lever safety valve, wireless mast, moment of a couple; Properties of a couple ; Simple applied problems such as pulley and shaft.

4. **GENERAL CONDITION OF EQUILIBRIUM: (04 Lectures)**

General condition of equilibrium of a rigid body under the action of coplanar forces, statement of force law of equilibrium, moment law of equilibrium, application of above on body.

5. **FRICTION: (07 Lectures)**

Types of friction: statical, limiting and dynamical friction, statement of laws of sliding friction, Coefficient of friction, angle of friction; problems on equilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

6. **MACHINES: (09 Lectures)**

Definition of a machine. Mechanical advantage, velocity ratio, input, output, mechanical efficiency and relation between them for ideal and actual machines. Law of a machine Lifting machines such as levers, single pulley, three system of pulleys. Weston differential pulley, simple wheel and axle, differential wheel and axle. Simple screw jack, differential screw jack, simple worm and worm wheel.

7. **STRESSES AND STRAINS: (11 Lectures)**

Concept of stress and strain. Concept of various types of stresses and strains . Definitions of tension, compression shear, bending, torsion. Concept of volumetric and lateral strains, Poisson's ratio. Changes in dimensions and volume of a bar under direct load (axial and along all the three axes). Ultimate stress, working stress. Elasticity, Hook's law, load deformation diagram for mild steel and cast iron. Definition of modulus of elasticity, yield point, modulus of rigidity and bulk Modulus. Stresses and strains for homogeneous materials and composite sections.

8. **BEAMS & TRUSSES: (11 Lectures)**

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, Bow's notation, space diagram, polar diagram, funicular polygon; calculation of reaction at the support of cantilever and simply supported beams and trusses graphically and analytically; graphical solution of simple determinate trusses with reference to force diagram for determining the magnitude and nature of forces in its various members. Analytical methods: method of joints and method of sections.(simple problems only)

9. **THIN CYLINDRICAL AND SPHERICAL SHELLS: (05 Lectures)**

Differentiation between thick and thin shells, cylindrical and spherical shells, thin spherical and cylindrical shells subjected to internal pressure, longitudinal stresses, circumferential or hoop stresses. longitudinal, circumferential and volumetric strains. Changes in the dimensions and volume of a thin shell subjected to internal fluid pressure.

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
6. Applied Mechanics by J K Kapoor & P S Kuswaha, Bharat Bharti Publications

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	05
2	12	10
3	10	05
4	4	05
5	7	05
6	9	05
7	11	05
8	11	05
9	5	05
Total	**75**	**100**

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MECHENICAL ENGINEERING MATERIALS

Sub. Code:-1.04

L	T	P
3	-	-

RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

LEARNING OUTCOMES

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

- Distinguish between metals and non metals and ferrous and non ferrous materials.
- Explain the arrangement of atoms in various crystals.
- Carryout various heat treatment processes.
- Analyze microstructure and changes in microstructure due to heat treatment.
- Classify various types of plastics and rubber.
- Explain properties and applications of composites, ceramics and smart materials.
- Select suitable material to be used for various engineering applications.
- Perform destructive and non-destructive testing of materials.

DETAILED CONTENTS

1. GENERAL INTRODUCTION: (04 Lectures)

Brief introduction to the subject metallurgy and its scope in engineering field, classification of materials of Industrial importance. Their chemical, thermal, electrical, Magnetic, mechanical and technological properties and their Selection criteria for use in industry.

2. STRUCTURE OF METALS AND THEIR DEFORMATION (15 Lectures)

Structure of metals and its relation to their physical, mechanical and technological properties. Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections. Deformation of metals, effects of cold and hot working operations over them. Recovery, recrystallisation and grain growth,

solid solutions, alloys and inter metallic compounds, allotropy of metals, effect of grain size on properties of metals. Corrosion-it's causes and prevention.

3. PROPERTIES AND USAGE OF METALS: (38 Lectures)

(1) (a) Ferrous Metals.
(b) Non Ferrous Metals.
(2) Nonmetallic Materials.

3.1. METALS:

(a) Ferrous Metals:

(i) Classification of iron and steel. Sources of iron ores and places of availability. Outline of manufacture of pig iron, wrought iron, cast iron and steel. (Flow diagram only)

(ii) Cast iron: Types as per I.S. - White, malleable, grey mottled, modular and alloy, properties and common uses.

(iii) Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Name and places of steel plant in India. Availability of various section of steel in market, its forms and specifications.

(iv) Alloy Steel : Effect of alloying various elements, viz Cr, Ni, Co, V, W, Mo, Si and Mn on mechanical properties of steel, Common alloy steels, viz,

(a) Ni-Steel
(b) Ni-Cr-steel
(c) Tungsten Steel
(d) Cobalt steel
(e) Stainless steel
(f) Tool steel- High Carbon Steel, High Speed tool Steel, Satellite Metal, and Tungsten Carbide Diamonds.
(g) Silicon manganese steel
(h) Spring steel
(i) Heat resisting alloy steels (Nimonic steels).
(j) Impact hardening steel

(b) Non-ferrous Materials:

(i) Important ores and their metal content, outline of manufacturing methods, trade names, properties (Phy/Mech./Elect.) and use of the following metals: Aluminium, Zinc, Copper, Tin, Silver, Lead.

(ii) Base metal with principle alloying elements (I.S.I. specification). Important properties and use of the following alloys:

(a) Aluminium Alloys: Aluminium-Copper alloy, Al, Zn alloy, Aluminium- Silica Alloy-Al-Ni-Alloy, Duralumnium-derived alloys (R.R. and Y-alloy).

(b) Copper Alloys: Brass, Bronze, Gun metal, Phosphor Bronze, Aluminium Bronze, Ni Bronze.

(c) Nickel Silver: Nickel-Copper Alloy (monel metal) inconel, Nickel, Silver.

(d) Bearing Metals: Lead base alloys, tin base alloys. (White metals or Babbitt metals) Copper base alloys.

(e) Solders: Solders-(Lead, Tin solder, Plumber solder, Tinman's solder or Tin solder) Silver solder, Brazing alloys (spelter), Inconel alloys.

3.2. NON-METALIC MATERIALS:

(a) Timber:

Conversion of Timber: Its meaning necessity, Seasoning of timber, Preservation of Timber : Types of preservation, Methods of application, Defects in timber, Surface treatment, Soaking treatment, Hot and Cold treatment; Common Indian timber specific uses, properties identification, units of purchase. Brief study of products of Timber, Plywood, Hard board, Batten Board, Veneer board.

(b) Plastic and Other Synthetic Materials:

Plastics-Important sources-Natural and Synthetic, Classification, thermo set and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms-Pallets, Granules, Powder and Liquid forms; Uses of Sun gloss resin, Linoleum, Plastic coated paper, Fibers-Important sources. Inorganic fibers, Natural Organic Fibers and Synthetic organic fiber and their use.

(c) Paints, Enamels, Varnishes and Lacquers:

Paints and Enamels-types, its purpose, essential ingredients and their role, characteristics of a good paints and enamel, Selection of different types of paints, varnishes from manufacture catalogue.

(d) Heat Insulating Materials:

Classification of heat: Insulating material, properties and uses of China clay, Cork, Slag wool, Glass wool, Thermo Cole, Puf, Properties and uses of asbestos as filler material.

(e) Electrical Insulating Materials:

Classification of electrical insulating materials, properties and use of-China clay, Leather, Prespan paper, empire cloth masonite, Bakelite, Ebonite, Fibre, Mica, Wood Wool, Glass wool, Rubber, Felt, Insulating oil and Varnish and Enamel paint. Electrical resistance and fuse materials.

(f) Hardwares:

General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. pipes and their uses. General sheets specification (I.S.) and uses. Method of storage of G.I. sheets, M.S. sheets, General

specification of pipe fittings viz. Elbow, Tee, Bend, Crosses and Sockets. General specification and use of wire nails, wood screws and door hinges, toggle bolts, sliding bolts.

4. IDENTIFICATION AND TESTING OF METAL ALLOYS: (08 Lectures)

Selection, specification forms and availability of materials. Testing of materials (Destructive and Non- Destructive), Identification of metal by giving mini project.

5. MISCELLANEOUS MATERIALS: (10 Lectures)

Important properties, characteristics and use of the following materials-

(a) Abrasives-Natural and Manufactured, sand stone, emery and corundum, diamond, garnet, silicon carbide, Boron carbide, aluminum oxide, another abrasives qualities of good abrasive.

(b) Celluloid or Xylonite

(c) Felt

(d) Magnetic Materials

(e) Mica

(f) Refractory Materials-Fire clay, Dolomite, Magnetite, Porcelain, Fire bricks and their uses

(g) Jointing Materials-Glues and Adhesives, Cements Pyroxylene cement, Rubber cement, Magnestic cement.

(h) Composite Materials : Introduction to polymers of metal matrix composite, Carbon fiber, Glass fiber Germanium alloys (metal glasses),Source of procurement of various Ferrous and non-Ferrous and composite materials

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Small projects
- Viva-voce

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the Institute/market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary
5. Material Science and Engineering by Raghavan, PHI
6. Material & Material Science By J.M.L. Gupta, Bharat Bharati Prakashan & Co.

7.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	5	12
2	15	16
3	38	40
4	7	12
5	10	20
Total	**75**	**100**

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ENGINEERING TECHNOLOGY & CALCULATIONS

Subject Code: 1.05

L	T	P
3	-	-

RATIOANELE

Diploma Engineers are responsible for supervising manufacturing/production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes and machine are required to be imparted. Hence the subject of Workshop Technology & Calculations is very important in the field of manufacturing / production.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Perform smoothly in the fitting workshop and machine shop
- Knowledge of various tools and operations of fitting shop.
- Knowledge of various joints and joining processes such as welding, soldering and brazing etc.
- Students will learn about various manufacturing / machining processes e.g. Drilling, Turning, Milling and Grinding etc.
- Detailed information about machines tools which are commonly use in the manufacturing or production.
- Knowledge of machining factors and parameters of Lathe Machine, Shaping Machine, Milling Machine, Boring Machine, Surface Grinding Machine and Cylindrical Grinding Machine.
- Knowledge of various workshop and machine calculations
- Calculation of cutting speed, feed, tool life, indexing etc.

DETAILED CONTENTS

FITTING SHOP

1. FAMILIARITY WITH TOOLS & MACHINES (15 Lectures)

1.1 Introduction of tools used in fitting shop

2.2 DETAIL STUDY: vice, hammer, Chisel, Files, scraper, Hacksaw, Arbor press, Band saw machine etc.

1.3 FITTING OPERATIONS

1. Marking, punching, chiseling, sawing, scraping, drilling, reaming, thread cutting, countersinking, boring.

1.4 TEMPORARY & PERMANENT JOINTS

1. Methods of fastening Various types of washers and bolts and nuts , Screw keys, cotters, riveting, welding, soldering, brazing.

2. MACHINING FACTORS (Definition Of Machining Parameter) (08 Lectures)

2.1 Transmission of motion & power

2.2 Metal cutting & cutting tools

2.3 Selection of cutting parameter

2.4 Function of machine parts
2.5 Speed, feed, depth of cut, metal removal rate
2.6 Power requirements

3. TOOL ROOM MACHINES (Principles of Working & It's Example) (22 Lectures)

3.1 Lathe Machine
3.2 Shaping Machine
3.3 Milling Machine
3.4 Boring Machine
3.5 Surface Grinding Machine
3.6 Cylindrical Grinding Machine

4. WORKSHOP CALCULATIONS (03 Lectures)

4.1 Trigonometry
4.2 Division of circle
4.3 Chordal distance
4.4 Tangential to circle

5. CALCULATION INVOLVE IN TURNING & MILLING (09 Lectures)

5.1 Cutting speed
5.2 Speed, Feed, depth of cut
5.3 Tapers
5.4 Chang gear calculation
5.5 Simple train
5.6 Compound Train
5.7 Calculation of thread cutting
5.8 Cutting Tool life
5.9 Tool Angles
5.10 Volume of metal removed in turning

6. CALCULATION IN MILLING & INDEXING HEAD (09 Lectures)

6.1 Cutters
6.2 No. of teeth
6.3 Speed
6.4 Feed
6.5 Machining time for milling
6.6 Dividing head
6.7 Simple indexing
6.8 Compound indexing
6.9 Differential indexing

7. CALCULATION OF CUTTING SPEED, FEED, DEPTH OF CUT, AND MACHINING TIME (09 Lectures)

7.1 Shaping
7.2 Planning Machine
7.3 Slotting Machine
7.4 Drilling
7**.**5 Reaming
7.6 Grinding

MEANS OF ASSESSMENT

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

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practical's.

RECOMMEMDED BOOKS

1. Elements of Workshop Technology VOL- I&II by S.K. Hajra Choudhury, S.K. Bose, A.K. Hajra Choudhury
2. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
3. Production Technology By R. K. Jain
4. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
5. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
6. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishng House, Roorkee.
7. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	15	20
2	8	10
3	22	30
4	3	04
5	9	12
6	9	12
7	9	12
Total	**75**	**100**

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MEASURMENTS AND METROLOGY - I

Subject Code : 1.06

L	T	P
2	-	-

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 dowel 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 (06 Lectures)

1.1 Scope and need of metrology in engineering field.
1.2 Metrology as a means of quality control.
1.3 Concept of the interchangeability, limits, fits, tolerances and accuracy.
1.4 Introduction of SI System
  1.4.1 Units
  1.4.2 Conversion

2. BASIC MEASURING INSTRUMENTS (NON PRECISION) (10 Lectures)

2.1 Basic linear measurements.
2.2 Basic linear measuring instruments.

2.3 Concept of each measuring instruments, steel rule, caliper, spring out side caliper, spring inside caliper, feeler gauge, caliper, firm joint out side caliper, radius gauge, firm joint inside caliper, divider, try square, straight edge, surface plates, glass surface plates, angle plate, V-Block, tool maker's straight edge.

3. BASIC MEASURING INSTRUMENTS (VERNIER) (08 Lectures)

3.1 Introduction of basic linear measurements.
3.2 Types of vernier instruments like vernier caliper, vernier depth gauge, vernier height gauge.
3.3 Concept of least count of each measuring instruments.
3.4 Principle and working of each type of measuring instrument.

4. BASIC MEASURING INSTRUMENTS (MICROMETRE) (10 Lectures)

4.1 Classification of different type of micrometer.
4.2 V-anvil micrometer.
4.3 Blade type micrometer.
4.4 Stick micrometer.
4.5 Dial micrometer.
4.6 Bench micrometer.
4.7 Differential micrometer.
4.8 Concept of least count of micrometers.
4.9 Depth Micrometer
4.10 Principle and working of each type pf micrometer.

5. BASIC MEASURING INSTRUMENT (ANGULAR) (08 Lectures)

5.1 Introduction of basic angular measuring instrument.
5.2 Bevel protractor.
5.3 Optical bevel protractor.
5.4 Standard angle gauge.
5.5 Principle of least count and working of each type of angular measuring instruments.

6. LIMITS AND FITS (06 Lectures)

6.1 Introduction of limits and fits and application.
6.2 Concept of interchangeability, tolerances, zero line and allowances.
6.3 Classification of fits, tolerances, limits, sizes and deviation.
6.4 Study different basic shaft and basic hole, grades of tolerance, standard tolerance, tolerance zone and relevant Indian Standard

7. GAUGES (General Introduction & Classification) (06 Lectures)

7.1 Introduction.
7.2 Plain limit gauges and application.
7.3 Concept of gauges
7.4 Classification of gauges, plug gauge snap, gauge, ring gauge.

8. INSPECTION (06 Lectures)

8.1 Sources of errors.

8.2 Errors and their effect on quality

8.3 Concept of errors, comparison / measurement, precision and accuracy.

8.4 Study source of errors, effect of errors on accuracy, precaution to be taken in measurement.

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

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

No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	10
2	10	14
3	08	14
4	10	14
5	08	12
6	06	14
7	06	14
8	06	8
Total	**60**	**100**

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ELECTRICAL & ELECTRONICS ENGINEERING

Sub. Code :-1.07

L	T	P
3	-	-

RATIONALE

Apart from the core subjects, some engineering subjects are included in this diploma course One
of these subjects is General Engg. which aims to impart some necessary knowledge and skill about other engg disciplines. Inclusion of the subject is further justified by the fact that inpractical field, any job of technician is intermingled. As such the relevant basic topics of these disciplines are included in the content of the subject. Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
• Identify and able to take readings on various electrical equipments(voltmeter, ammeter, CRO, wattmeter, multi-meter)
• Determination of voltage-current relationship in a DC circuit under specific physical conditions
• Measure resistance of an ammeter and a voltmeter
• Verify Kirchhoff's Current and Voltage Laws in a dc circuit
• Find the ratio of inductance of a coil having air-core and iron-core respectively and observe the effect of introduction of a magnetic core on coil inductance
• Measure power and power factor in a single phase R-L-C Circuit and calculation of active and reactive powers in the circuit.
• Measure voltages and currents in polyphase a.c. circuits for star and delta connections.

DETAILED CONTENTS

1. ELECTRIC INDUCTION: (04 Lectures)

Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and Dynamically induced e.m.f., Lenz's law. Fleming's left hand and right hand rule.

2. A. C. THEORY: (09 Lectures)

Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantneous, Average, R.M.S. maximum values of sinosoidal wave. Form factor, peak factor. Representation of a sinosoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance,impedance. Solution and

phasor diagrams of simple R.L.C. series and parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS: (08 Lectures)

Production of Three phase voltage, advantages of three phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three phase circuits, simple numerical problems.

4. MEASUREMENT & MEASURING INSTRUMENTS: (09 Lectures)

(i) Primary and secondary instruments-Indicating, Recording and Integrated instruments.
(ii) Working principle and construction of the following instruments.
  (a) Ammeter & Voltmeter (Moving coil & Moving Iron). Extension of their ranges.
  (b) Dynamometer type wattmeter.
  (c) Single Phase A. C. Engery Meter.
(iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use fo digital multimeter for measurement of voltage, Current and testing of devices.

5. ELECTRONICS: (09 Lectures)

Basic idea of semi conductors P & N type. Semi conductor diodes, Zener diodes and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses at an amplifier (Brief description only). Prniciple characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. MACHINES: (06 Lectures)

D. C. Generator: Working principle, Constructional details, e.m.f. equation, Types of generators and their applications- D. C. Motor: Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. TRANSFORMERS: (04 Lectures)

Working principle and constructional details of a single phase and 3 phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementary idea of auto transformers and welding transformers.

8. SYNCHRONOUS MACHINES: (08 Lectures)

(a) Alternators: Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.
(b) Synchronous Motors: Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

9. INDUCTION MOTORS: (08 Lectures)

(a) Three Phase Induction Motors: Working principle and constructional details-Types of induction motors-Slipring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.
(b) Single Phase Induction Motors: Working principle and constructional details and application of single phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.

10. ELECTRO HEATING: (05 Lectures)

Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. ELECTROPLATING: (03 Lectures)

Importance of electroplating, Principle of electroplating and equipment used. Processes used in electroplating, Anodizing.

12. Introduction of sensors for Linear Measurement **(02 Lectures)**

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal, Tata Mc Graw-Hill Education Pvt Ltd., New Delhi.
2. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.
3. Electrical Technology, Volume-I & II by BL Theraja, S Chand and Co, New Delhi.
4. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi.
5. Basic Electrical Engineering by Asfaque Husain, Jain Book Depot, New Delhi
6. Modern Digital Electronics,By R P Jain, Tata Mcgraw Hill Publishing House, New Delhi
7. A practical Book on Electrical Safety,CIMI Chennai,CIMI Chennai

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	4	08
2	9	14
3	8	08
4	9	10
5	9	10
6	6	10
7	4	06
8	8	16
9	8	06
10	5	06
11	3	03
12	2	03
Total	**75**	**100**

ENGINEERING DRAWING- I

Subject Code : 1.08

L	T	P
2	-	2

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.

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
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances

DETAILED CONTENTS

1. INTRODUCTION TO ENGG. DRAWING. (03 Lectures)

1.1 Introduction & Observation of Engg. Drawing
1.2 Practice in the tool room.

2. INTRODUCTION TO DRAWING INSTRUMENT. (02 Lectures)

2.1 Drafting machine(Mini drafter), Drawing instrument & their accessories

3. INTRODUCTION OF STANDARD DRAWING SHEETS. (04 Lectures)

3.1 Sheet sizes
3.2 Layout of Drg. Sheet
3.3 Title Block
3.4 Bill of material
3.5 Folding of prints

4. CLASSIFICATION OF SCALES (03 Lectures)

4.1 Full Scale
4.2 Reduced Scale
4.3 Enlarged Scale

5. CLASSIFICATION OF LINE (03 Lectures)

5.1 Types of Lines & Their General Applications

6. DETAIL STUDY OF TECHNICAL LETTERING (05 Lectures)

7. GEOMETRICAL CONSTRUCTIONS (08 Lectures)

7.1 Introduction to Examples of Geometrical Construction
a Division of Lines and Angle, Construction of Polygon, Circle/Arc

8. **THEORY OF ORTHOGRAPHIC PROJECTIONS. (15 Lectures)**

8.1 Principle of Projections
8.2 Orthographic Projections
8.3 Orthographic systems of Projection
8.4 Co-ordinate plane of Projection
8.5 Principles of co-ordinates & planes
8.6 Introduction to 1st & 3rd Angle Projections
8.7 Procedure for drawing different views of an object in 1st & 3rd Angles
8.8 Difference between 1st angle projection method & 3rd angle projection method
8.9 Study of 1st & 3rd angle orthographic Projections according to block diagram
8.10 Practice on different types of objects like Round, Square, Rectangular

9. **STUDY OF ISOMETRIC VIEWS (03 Lectures)**

10. **EXERCISE OF MISSING LINES & VIEWS IN 1st & 3rd ANGLE PROJECTIONS (03 Lectures)**

11. INTRODUCTION TO SECTIONAL VIEWS (07 Lectures)

11.1 Types of section, sectional lines & assembly sectioning

a. Cutting plan line
b. Hatching
c. Full sections
d. Half sections
e. Off-set sections
f. Revolved sections
g. Local sections(partial sections or broken out sections)
h. Aligned sections
i. Removed sections
j. Auxiliary sections
k. Adjacent sections
l. Disposition of successive sections
m. Thread in sections

12. **INTRODUCTION TO DIMENSIONING** **(04 Lectures)**

a. General Principles
b. Aligned System
c. Unidirectional System

13. **METHOD OF PLACEMENT OF TOLERANCES IN ENGG. DRG. ACCORDING TO THEIR APPLICATION** **(02 Lectures)**

14. **CONVENTIONAL REPRESENTATION (SYMBOLS) OF COMMON FEATURES** **(03 Lectures)**

a. Material
b. Gears
c. Splines & hubs
d. Springs
e. Gear assemblies

15. **FASTENERS** **(06 Lectures)**

a. Screw threads
b. Bolts
c. Nuts
d. Rivets

16. **WELDING SYMBOLS** **(02 Lectures)**

16.1 Descriptions

17. **ABBREVIATIONS USED IN ENGINEERING DRAWINGS** **(02 Lectures)**

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
− Minimum of 12 sheets to be prepared
− Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

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.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	3	04
2	2	02
3	4	08
4	3	04
5	3	06
6	5	06
7	8	10
8	15	22
9	3	04
10	3	04
11	5	08
12	4	04
13	2	02
14	3	04
15	6	06
16	2	02
17	2	02
18	2	02
Total	**75**	**100**

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WORKSHOP PRACTICE - I

Subject Code: 1.09

L	T	P
-	-	2

I YEAR

1. BASIC KNOWLEDGE & SKILLS IN METAL WORKING
   a) Filing & making flat surfaces
   b) Using of steel rule for measuring & checking
   c) Checking with try square & measuring with v-caliper
   d) Marking with scriber, divider and calipers using centre punch
   e) Using hand hacksaw
   f) Chiseling with cross cut chisel, flat chisel and oil groove chisel
   g) Using different hammers
   h) Drilling reaming counter boring & counter sinking by using bench & column drilling machine
   i) Use of different cutting speeds, feeds & depth of cut
   j) Using power hacksaw machining
   k) Re sharpening of chisels centre punches, scribers drills etc. and pedestal grinding machine

2. BASIC KNOWLEDGE AND SKILLS IN MACHINING LATHE

   a) Plain turning, step turning, facing & taper turning
   b) Grooving, threading & parting off
   c) Drilling, boring, step boring & under cuts
   d) Farm turning & knurling
   e) Grinding a single point tool for plain turning step, turning, grooving, threading etc, with positive, zero & negative rake
   f) Turning job on lathe by using scribing block and dial indicator

3. SHAPING

   a) Shaping plain surfaces & steps
   b) Angular surfaces & grooves
   c) Grinding of the tools for shaping
   d) Dialing with dial indicator on shaping machine.

4. MILLING

   a) Setting the R.P.M.
   b) Plain milling by slab mill cutter on horizontal milling machine

c) Plain milling by shell and mill cutter on vertical milling machine
d) Step milling & angular milling on horizontal and vertical milling machine
e) Slot milling on horizontal vertical milling

5. SURFACE GRINDING
   a) Surface grinding of plain surfaces
   b) Step grinding
   c) Slot grinding
   d) Dressing of grinding wheel

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MECHANICS OF SOLIDS

Sub. Code:-2.01

L	T	P
3	-	-

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

LEARNING OUTCOMES

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

- interpret various concepts and terms related to strength of materials
- calculate stresses in bars of various cross-section.
- calculate energy stored by materials subjected to axial loads.
- calculate moment of inertia of different sections.
- interpret the concept of bending and torsion and calculate stresses on different section of materials.
- draw and calculate shear force and bending moment diagrams of beam under given loading
- calculate stresses in thin cylindrical shells.
- determine the diameter of a shaft under combined bending and torsion.
- calculate critical axial loads on column under different end constraints.

DETAILED CONTENTS

1. STRESS, STRAIN AND PROPERTIES OF MATERIALS: (08 Lectures)

Mechanical properties of materials- Ductility, Tenacity, Brittleness, Toughness, Hardness, Factor of safety. Different types of loads and stresses, strain in a stepped bar. Determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only, stresses in compound bars and columns. Equivalent modulus of a compound bar, temperature stresses. Shrinkage of a tyre on a wheel. Temperature stress in compound bar, stress-stain curves for mild steel, Aluminium, cast iron & rubber.

2. COMPLEX STRESSES: (09 Lectures)

Stresses on an oblique plane in a body subjected to direct load, concept of compound stresses. Principal stress and Principal planes under direct and shear stresses. Graphical determination by Mohr's circle.

3. SHEAR FORCE AND BENDING MOMENT: (16 Lectures)

Shear force and bending moment for concentrated and uniformly distributed loads on simply supported beams, cantilever and overhanging beam. Shear force and bending moment diagrams. Relationship between shear force and bending moment. Point of contra flexure, calculations for finding the position of contra flexure. Condition for maximum bending moment.

4. THEORY OF SIMPLE BENDING: (09 Lectures)

Simple bending, examples of components subjected to bending such as beam, axle, carriage spring etc..Assumptions made in the theory of simple bending in the derivation of bending formula. Section Modulus Definition of neutral surface and neutral axis and calculation of bending stresses at different layers from the neutral surface for beam of different sections, Pure bending.

5. STRAIN ENERGY: (07 Lectures)

Meaning of strain energy and resilience. Derivation of formula for resilience of a uniform bar in tension. Proof resilience, modulus of resilience, suddenly applied load, Impact or shock load. Strain energy in a material subjected to uniaxial tension and uniform shear stress. General expression for total strain energy of simple beam subjected to simple bending.

6. TORSION: (08 Lectures)

Strength of solid and hollow circular shafts. Derivation of torsion equation. Polar modulus of section. Advantages of a hollow shafts over solid shaft. Comparison of weights of solid and hollow shafts for same strength. Horse power transmitted. Calculation of shaft diameter for a given horse power.

7. SLOP & DEFLECTION: (10 Lectures)

Slop & Deflection of simple cases of cantilever and simply supported beams with concentrated and uniformly distributed loads (standard elementary cases only with no proof of formulae) conditions for circular bending.

8. COLUMNS AND STRUTS: (08 Lectures)

Definition of long column, short column and slenderness ratio. Equivalent length, Critical load, Collapsing load, End conditions of columns. Application of Euler's and Rankin's formula (No Derivation). Simple numerical problems.

MEANS OF ASSEESSMENT

−Assignments and quiz/class tests
−Mid-term and end-term written tests
−Small projects
−Viva-voce

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

RECOMMENDED BOOKS

1. SOM by Birinder Singh; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Mechanics of Materials by Dr.Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.
5. Mechanics of Solids by Karmveer Saini, Krishna Publication House, Meerut.
6. 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	8	10
2	9	10
3	16	20
4	9	10
5	7	10
6	8	16
7	10	14
8	08	10
Total	**75**	**100**

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ENGINEERING MATHEMATICS II

Sub. Code:-2.02

L	T	P
3	1	-

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 : (15 Lectures)

1.1 **Algebra of Matrices, Inverse :**

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Determinant of a matrix, Cofactors, Definition and Computation of inverse of a matrix.

1.2 Elementary 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 a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vactors, Consistency of equations.

1.4 **Types of Matrices** :

Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthogonal, Unitary, diagonal and Triangular.

1.5 **Eigen Pairs, Cayley-Hamilton Theorem** :

Definition and evaluation of eigen values and eigen 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. ORDINARY DIFFERENTIAL EQUATION: (18 Lectures)

2.1 **Formation, Order, Degree, Types, Solution** :
Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree and Meaning of solution of a differential equation, Linear, Nonlinear equation.

2.2 **First Order Equations** :
Variable separable, equations reducible to separable forms, Linear and Bernoulli form exact equation and their solutions.

2.3 **Second Order Linear Equation** :
Property of solution, Linear equation with constant coefficients, cauchy type equation. Homogeneous and Non- homogeneous equations, equations reducible to linear form with constant coefficients.

2.4 **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

3. DIFFERENTIAL CALCULUS-II : (15 Lectures)

3.1 **Function of two variables, identification of surfaces in space**

3.2 **Partial Derivatives** :
Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Eulers theorem for homogeneous functions, Jacobians.

3.3 **Vector Calculus** :
Vector function, derivatives, gradient, divergence and curl, double and triple integral, surface integral, Green, Gauss and stokes theorem and application

4. INTEGRAL CALCULUS – II (15 Lectures)

4.**1 Laplace Transform** :
Definition, Basic theorem and properties, Unit step and Periodic functions, Solution of ordinary differential equations

4.2 **Beta and Gamma Functions** :
Definition, Use, Relation between the two, their use in evaluating integrals.

4.3 **Fourier Series** :
Fourier series of f(n)-ã<x<ã, Odd and even function, Meaning of the sum of the series at various pairs.

5. PROBABILITY AND STATISTICS : (12 Lectures)

5.1 Probability : Laws and Conditional probability
5.2 Distribution : Discrete and continuous distribution.
5.3 Binomial Distribution : Properties and application through problems.
5.4 Poisson Distribution : Properties and application through problems
5.5 Normal Distribution : Properties and applications through problems
5.6 Method of Least-square

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

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/UBTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	15	15
2	18	15
3	15	30
4	15	25
5	12	15
Total	**75**	**100**

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TOOL MATERIALS & HEAT - TREATMENT

Subject Code : 2.03

L	T	P
3	-	-

RATIONALE

A lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

LEARNING OUTCOMES

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

- distinguish between metals and non metals and ferrous and non ferrous materials.
- Carryout various heat treatment processes.
- analyze microstructure and changes in microstructure due to heat treatment.
- explain properties and applications of composites, ceramics and smart materials.
- select suitable material to be used for various engineering applications.
- perform destructive and non-destructive testing of materials.

DETAILED CONTENTS

1. **INTRODUCTION OF HEAT-TREATMENT (08 Lectures)**
   - 1.1 Over view of heat-treatment
   - 1.2 Concept of heating & cooling of metals
   - 1.3 Principle of heat-treatment
   - 1.4 Study & identify elements of heat-treatment

2. **PHASE DIAGRAM WITH SPECIAL REFERENCES TO IRON & STEEL (12 Lectures)**
   - 2.1 Iron carbon phase diagram
     - 2.1.1 Iron carbon phase diagram & its application
     - 2.1.2 Concept of iron carbon phase diagram
     - 2.1.3 Classification of phases, concept of allotropy of iron
     - 2.1.4 Principles of iron carbon phase diagram, the transformation of phases, allotropy of iron
   - 2.2 Micro constituents of Iron & Carbon System
     Understand micro constituents of iron carbon systems
     - 2.2.1 Concept of micro constituents of various phases
     - 2.2.2 Principle of micro constituents of various phases

3. HEAT-TREATMENT OF TOOL STEEL (22 Lectures)

3.1 Heat Treatment Of Metals-
Elementary concept, purpose, Iron-carbon equilibrium diagram. T.T.T. or 'S' curve in steels and its significance, micro structure of steels and martensitic transformation (elementary idea). Hardening, Tempering, Annealing, Normalizing and case hardening. Ageing, Various temperature ranges for different metals and alloy (From heat treatment hand book)
3.2 Dimensional changes in Heat-treatment
3.3 Effect of composition on tool performance
3.4 Distortion in tool steels
3.5 Nature and causes of distortion
3.6 Control of distortion
3.7 Normalizing
3.8 Annealing and stress relieving of tool steels
3.9 Preheating for austenitizing
3.10 Quenching
3.11 Tempering
3.12 Carburizing
3.13 Nitriding of tool steels

4. GENERAL STUDY OF CUTTING TOOL MATERIAL (12 Lectures)

4.1 Metal cutting and associated requirement of different properties of the cutting tools
4.2 Generally used metals, non metals and alloys as cutting tool
4.3 Selection of materials for a cutting tool depending upon several factors-the metal cutting machines, cutting operation machinability size etc.

5 TYPES OF TOOL STEEL (General Introduction & Application) (15 Lectures)

5.1 Water hardening tool steels
5.2 Shock resisting tool steels
5.3 Oil hardening cold work steels
5.4 Air hardening medium alloy cold work tool steels
5.5 High carbon high chromium cold work steels
5.6 Chromium hot work tool steels
5.7 Tungsten hot work tool steels
5.8 Molybdenum hot work steels
5.9 Tungsten high speed steels
5.10 Molybdenum high speed steels
5.11 Carbon tungsten tool steels
5.12 Hardenability and hardenabililty tests
5.13 Defects in tool steels

6. POWDER METALLURGY OF SINTERED CARBIDE IN METAL WORKING INDUSTRIES (04 Lectures)

6.1 Principal properties of sintered carbide used in metal cutting and non-cutting shaping

7. CERAMIC AS CUTTING TOOL MATERIAL (02 Lectures)

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Small projects
- Viva-voce

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the Institute/market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary
5. Material Science and Engineering by Raghavan, PHI
6. Material & Material Science By J.M.L. Gupta, Bharat Bharati Prakashan & Co.
7.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	8	10
2	12	20
3	22	25
4	12	15
5	15	10
6	4	10
7	2	10
Total	**75**	**100**

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TOOL ENGINEERING – I

Subject Code : 2.04

L	T	P
3	-	-

RATIONAL

In manufacturing process during machining, holding or fixing the workpiece in a certain position is very important. Specially the work piece of irregular shape and size are very difficult to hold on machine. Engineers develop special holding devices called jigs and fixtures, to hold such irregular shape and size of workpiece. After production it is very important to know that the product is as per the design or not. For the checking of the product gauges are used in production shop. In tool engineering-I student learn terminology and manufacturing of gauges, jigs and fixtures.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Quality control of the product in manufacturing unit.
- Detailed knowledge of the limit, fit, tolerance, allowance etc.
- Student can manufacture various types of Gauges.
- Detailed knowledge of jigs and fixtures.
- Design of jig and fixtures
- Student can develop or manufacture jigs and fixtures for the components or workpieces.
- Knowledge of manufacturing process of Gauges, Jigs and Fixtures etc.

DETAIL CONTENT

1. GAUGES (35 Lectures)

1.1 TERMINOLOGY AND CLASSIFICATION OF GAUGES.

(i) Definition of tolerance and allowance.
(ii) Classification.
(iii) Fits – Class of tolerance and their application.
(iv) Disposition of tolerances.
(v) Introduction to limit gauges.
(vi) Meaning of ‘GO’ and ‘NO GO’ gauges.
(vii) Tolerance analysis.
(viii) Design of gauge.
(ix) Taylor’s Principle for designing of plain GO and NO GO limit gauges.

1.2 MATERIALS AND TREATMENT OF GAUGES.

(i) Case hardening steel.
(ii) Cast steel.
(iii) Carbon steel.

(iv) Plating of hard alloys and other materials.
(v) Heat treatment of gauges.

1.3 TYPES OF GAUGES AND THEIR USES.

(i) Plug gauges.
(ii) Snap or gap gauges.
(iii) Flush pin gauges.
(iv) Taper gauges.
(v) Thread gauges.
(vi) Recess gauges.
(vii) Position gauges.

1.4 PROCESS IN MANUFACTURING

(i) Hand scraping.
(ii) Cylindrical grinding.
(iii) Form grinding.
(iv) Surface grinding.
(v) Lapping.

1.5 RECLAMATION OF GAUGES.

(i) Chromium plating.
(ii) Conversion of gauges to next useful size.

1.6 INSPECTION OF GAUGES
1.7 APPLICATION OF COMPOUND SINE – TABLE.

2. JIGS AND FIXTURES. (40 Lectures)

2.1 INTRODUCTION AND DEFINITION.
(i) Definition of jigs and fixture.
(ii) Economic approach to jigs and fixture.
(iii) Difference between jigs and fixtures.

2.2 PRINCIPLES OF JIGS AND FIXTURE.
(i) Location.
(ii) Clamping.
(iii) Clearance.
(iv) Stability and rigidity handling.
(v) General principles of jigs and fixtures.

2.3 LOCATING AND CLAMPING ELEMENTS.
(i) Locating devices.
(ii) Locating support and diamond pins.
(iii) V- location.
(iv) Bush location.
(v) Material for locating devices.
(vi) Level clamps.

(vii) Clamps with floating pads.
(viii) Hinged clamps.
(ix) Cam operated clamps.
(x) Materials for clamping devices.

2.4DRILL JIG BUSHES AND PLATES.
(i) Fixed bushes.
(ii) Liner bushes.
(iii) Renewable bushes.
(iv) Slip bushes.
(v) Clamping bushes.
(vi) Drill bush materials.
(vii) Dimensioning of drill bush plates.

2.5JIGS FOR DRILLING OPERATIONS.
(i) Jig bodies.
(ii) Plate jigs.
(iii) Solid type jigs.
(iv) Turnover jigs.
(v) Local jigs.
(vi) Pot jigs.
(vii) Swinging jigs.
(viii) Catch jigs.
(ix) Box jigs.

2.6FIXTURES FOR
(i) Turning operations.
(ii) Milling operations.
(iii) Grinding operations.
(iv) Broaching and other operations.

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Small projects
- Viva-voce

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

RECOMMENDED BOOKS

1. Basic Die Making By Dr. Eugene Ostergaard, Mcgraw Hill Book Co.
2. Press Tool Design & Construction By Prakash H. Joshi, Wheeler Publishing
3. Fundamental of Tool Design, ASTME, Prentice Hall of India Pvt.Ltd.,New Delhi

4. Tool Design By C.Donaldson, Geotge H Lecain,V.C Goold ,Tata mcgraw Hill Publication,New Delhi
5. Workshop Technology, Volume-I,II,III By Chapman A.J.,Amol Publication,New Delhi
6. Workshop Technology By B.S.Raghuvanshi,New Heights,New Delhi
7. All about machine Tools By Gerling, Wiley Eastern, New Delhi
8. Tool & Die maker By B.Kishore,Saurabh & co., New Delhi
9. Theoretical Training Manual By NTTF,NTTF Bangalore
10. Practical Training Manual By NTTF,NTTF Bangalore
11. Element of workshop Technology,Hazra S K & Chaudhary S K ,Metropolitan Publishers,Mumbai
12. E-books/e-tools/relevant software to be used as recommended by AICTE / UBTE / NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	40
2	40	60
Total	**75**	**100**

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TOOL ENGINEERING-II

Subject Code: 2.05

L	T	P
3	-	-

RATIONAL

Sheet metal forming is an industrial process in which forces are applied to a piece of sheet metal to modify its geometry without removing any material. It is used in all the sectors of industrial production viz. automotive, aircraft, home appliance, food industry etc. Sheet metals are used in many intense industries, including aerospace, automotive, electronics, and farming. Their high strength and versatility make them ideal materials for parts like enclosures, brackets, assemblies, weldments, cabinets, and housings, as well as prototypes.

LEARNING OUTCOME

- In-depth knowledge of use and application of sheet metals
- Able to manufacture various parts and components
- Their specific use as per requirement of industry

DETAILED CONTENT

1. INTRODUCTION TO MASS PRODUCTION OF SHEET METAL COMPONENTS (04 Lectures)

1.1 Concept of sheet material, sheet material components and application

1.2 Principle of press tools for mass production of sheet material components.

2. SHEET METAL CUTTING OPERATIONS (06 Lectures)

2.1 **Sheet metal cutting operations**- Shearing, Cutoff, Parting, Perforating, Notching, Lancing, Trimming, Shaving, Blanking, piercing

2.2 Classification of shearing operations, shearing action in metal cutting.

3. SHEET METAL NON CUTTING OPERATIONS (06 Lectures)

3.1 Concept of plastic deformation and forming, classification of forming operation,

3.2 **Sheet metal Forming operations-** Bending, Embossing, Curling, Bulging, Tube forming, flanging, coining,

3. ELEMENTS & PARTS OF A SINGLE STATION BLANKING DIES (05 Lectures)

4.1 Standard parts, function, nomenclature & material used for different elements.

4.2 Effect of shearing clearance, edge characteristics, die clearance, stripping and ejection.

5. TYPES OF DIE CONSTRUCTION (03 Lectures)

5.1 Push through die, progressive die, compound die, combination die, inverted die.

6. DIE DESIGN TECHNIQUE (06 Lectures)

6.1 Types of die set and component, accuracy, materials, thickness.
6.2 Strippers- types, stripping action.
6.3 Die block construction- types, advantage & disadvantage, design parameter with respect to cutting clearance, angular clearance, land, die block thickness.
6.4 Sheet metal cutting formulas- blanking force, stripping force
6.5 Strip layout- Classification, parameter for strip layout, piloting and stopping, grain direction, burr side consideration, optimum material utilization.

7.0 STOCK STOPS & AUTOMATIC STOPS (02 Lectures)

7.1 Basic principles, types, design aspect of stoppers.

8.0 PUNCHES & PERFORATORS (03 Lectures)

8.1 Types, mounting of punches, punch life, guiding of punches in the stripper plates, manufacturing of punches.

9.0 PILOTS (03 Lectures)

9.1 Types, method of fixing, pilot size, materials, pilot guiding, mounting of pilots.

10.0 BENDING DIES (06 Lectures)

10.1 Introduction to bending and its classification.
10.2 **Design parameter for bending-** Blank development, stripping force, spring back, grain direction, concept of applying clearing, bending force.
10.3 Functional elements, guiding & locating elements, clamping elements, ejection.

11. FORMING DIES (04 Lectures)

11.1 Classification of forming dies- Solid form dies, Pad type dies, Curling Dies, Embossing Dies, Bulging dies, rubber Pad forming dies , Explosive forming, Vaccum forming

12.0 DRAWING DIES (08 Lectures)

12.1 Introduction to drawing dies, metal flow during drawing, variables that affect metal flow.
12.2 **Design parameter for drawing dies –** Calculation of drawing force, blank holding force, Stripping force, Blank development, Die cushion, Venting & Lubricating, percentage ratio & draw depth, Calculation of no. of draws, allowance for trimming, Inverted draw dies.
12.3 Manufacturing aspect of draw dies- Concept of construction of draw dies, Functional elements, guiding & locating elements, clamping elements, ejection elements.
12.4 Deep Drawing.

13. FINE BLANKING- (06 Lectures)

13.1 Introduction to fine blanking operation with respect to sheet material and press.
13.2 Concept of shearing, construction of elements such as functional elements, guiding & locating elements, clamping elements, ejecting elements, material selection & lubrication, main feature of press for fine blanking.

14.0 PRESS FOR PRESS TOOL OPERATIONS (05 Lectures)

14.1 understanding press for press tool operations, classification of presses, concept of shut hight, die cushion, specification of presses, selection of presses, tonnage, various steps performed in press working operation.

15. MATERIAL FEEDING AND SCRAP HANDLING DEVICES (04 Lectures)

15.1 Introductions to material feeding and scrap handling equipments in press operation, classification of material feeding and scrap handling equipments, safety to operator, equipments, tools.

16. DIE MAINTENANCE, STORAGE AND SAFETY (04 Lectures)

16.1 Procedure for maintenance, Safety, storage of press tools & machine.

MEANS OF ASSEESSMENT

−Assignments and quiz/class tests
−Mid-term and end-term written tests
−Small projects/WORKSHOP PRACTICE
−Viva-voce

INSTRUCTIONAL STRATEGY

1 Use of suitable models and real-life examples for better standing.
2. Apart from blackboard teaching, videos clips of process from industry be used for explanation of processes and machines involved.

RECOMMENDED BOOKS

1. Fundamental of Tool Design, ASTME, Prentice Hall of India Pvt.Ltd.,New Delhi
2. Tool Design By C.Donaldson, Geotge H Lecain,V.C Goold ,Tata mcgraw Hill Publication,New Delhi
3. Theoretical Training Manual By NTTF,NTTF Bangalore
4. Practical Training Manual By NTTF,NTTF Bangalore
5. Die design fundamentals by Paquin,JR
6. Basic Die making by D.Eugene Ostergaard, McGraw Hill Publication
7. Advance Die making D.Eugene Ostergaard, McGraw Hill Publication
8. Tool Engineering Hand book by Tata McGraw Hill
9. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR,Chandigarh.

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	4	04
2	6	08
3	6	08
4	5	06
5	3	06
6	6	08
7	2	02
8	3	04
9	3	04
10	6	08
11	4	08
12	8	10
13	6	06
14	5	08
15	4	05
16	4	05
Total	**75**	**100**

MEASURMENT AND METROLOGY-II

Subject Code : 2.06

L	T	P
2	-	-

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.
- use the concept of limits, fits and tolerance in assembly of components

DETAILED CONTENTS

1. PRINCIPLES OF MEASURING INSTRUMENTS (06 Lectures)

1.1 Introduction.
1.2 Principle of linear measuring instruments.
1.3 Lever method.
1.4 Vernier method.
1.5 Screw and screw nut method.
1.6 Compound gearing method.
1.7 Helical strip method.

2. PRINCIPLES OF OPTICAL INSTRUMENTS (06 Lectures)

2.1 Introduction.
2.2 Classification of optical instruments
2.3 Reflection.
2.4 Refraction.
2.5 Interference.
2.6 Optical prism.
2.7 Lances.
2.8 Optical projectors.

3. PRINCIPLES OF ELECTRICAL MEASURING INSTRUMENTS (04 Lectures)

3.1 Introduction.
3.2 Transformation of energy.
3.3 Variation of energy.

4. SURFACE FINISH (15 Lectures)

4.1 Introduction.
4.2 Surface texture and related method of measurement.
4.3 Surface texture measurement.
4.4 Concept of surface roughness, waviness and terminology as per Indian standards.
4.5 Methods of measuring surface finish, qualitative and quantitative.
4.6 Qualitative
- (i) Touch inspection.
- (ii) Visual inspection.
- (iii) Scratch inspection.
- (iv) Microscopic inspection.
- (v) Reflected light intensity.
- (vi) Surface photographs.

4.7 Quantitative.
- (i) Inter section method.
- (ii) Interference method.
- (iii) Stylus method.
- (iv) Replica method.

5. COMPRATORS (10 Lectures)

5.1 Introduction of comparators and its application.
5.2 Difference between a comparator and measuring instrument.
5.3 Classification of comparators.
- (i) Mechanical comparator (Dial indicator, sigma comparator, read type mechanical comparator).
- (ii) Electrical comparator.
- (iii) Optical comparator.
- (iv) Pneumatic comparator.

5.4 Study, working principal and amplification of all types of comparators.

6. ANGULAR MEASURMENTS (06 Lectures)

6.1 Advance angular measurement introduction.
6.2 Angular and taper measurements.
6.3 Concept of angular measurement, sine bar, sine setting devices, clinometers, dividing heads, autocolimeter and angle gauges.

7. SCREW THREAD AND GEAR METROLOGY (10 Lectures)

7.1 Screw thread terminology and angular tooth terminology and testing.
7.2 Screw thread measurement and gear tooth measurement.
7.3 Concept of screw thread, thread parameters, various types thread e.g. Metric and B.S.W., concept of measurement.
7.4 Study screw thread metrology and apply different methods for checking, two wire method and three wire method.
7.5 Concept of gear terminology of spur gear and checking with the gear tooth vernier.

8. GEOMETRICAL ERRORS (08 Lectures)

8.1 Inspection of geometrical errors.
8.2 Checking of each geometric errors.
8.3 Define of the geometric errors.
8.4 Straightness, flatness, parallalism, squareness, roundness, circularity and its representation of symbols.
8.5 Use and precaution of the instrument handling and used for inspecting geometric errors.

9. MACHINE TOOL TESTING (10 Lectures)

9.1 Methods of machine tool testing.
9.2 Classification of methods of machine tool testing techniques.
(i) Flatness, squareness of machine bed.
(ii) Alignment of axis.
(iii) Spindle axis and bed.
(iv) Spindle axis and line of centre.
(v) Axial slip of load screw calibration.
(vi) IS specification of measuring instruments.

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	06	10
2	06	10
3	04	05
4	15	20
5	10	15
6	06	10
7	10	10
8	08	10
9	10	10
Total	**75**	**100**

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PRECISION MACHINES

Subject Code : 2.07

L	T	P
2	-	-

RATIONAL

This Diploma course requires an in-depth understanding of various machine tools used in manufacturing of tools, dies and molds. This subject deals with the machine tools mostly used in Tool Rooms for precision work and manufacturing of tools and die.

LEARNING OUTCOME

1. Understanding the precision requirement of manufacturing of dies and tools
2. Able to select right type of machine tools for manufacturing of dies and tools
3. Enable them selecting various different productive tools and accessories available for carrying out different precision operation

DETAILED CONTENT

1. JIG BORING MACHINE (14 Lectures)

1.1 Specification and use of jig boring machine.
1.2 Accessories of jig boring machine.
1.3 Types of tools and their applications.
1.4 Types of operations on jig boring machine, selection of tools for different operations.
1.5 Different types of work holding devices.
1.6 Contouring of outside and inside diameter and also of rectangular work pieces.
1.7 Types of jig boring methods.
1.8 Application of rotary and tilting table for indexing.
1.9 Boring of offset inclined holes on circular and rectangular work pieces.
1.10 Use of different types of precision instruments for checking.

2. TOOL & CUTTER GRINDING MACHINE (04 Lectures)

2.1 Principles
2.2 Working
2.3 Application

3. OPTICAL PROFILE GRINDING MACHINE (08 Lectures)

3.1 Types of profile grinding machines and principals of working.
3.2 Materials and jobs ground including form cutting tools.
3.3 Safety precautions.
3.4 Grinding wheel and their materials.
3.5 Wheel selection.
3.6 Wheel balancing.
3.7 Manipulation of controls.

3.8 Illuminating lamps, projection screen, driving system of wheel, wheel head, tilting head, reciprocating stroke, truing devices.
3.9 Handling accessories and attachments.
3.10 Daily maintenance of machine.

4. SPARK EROSION MACHINE (18 Lectures)

4.1 History of E.D.M.
4.2 Spark erosion technology.
4.3 Kinds of power supply units.
4.4 Servo mechanism, die electric fluids, current density, metal removal rate, over cut and surface finish.
4.5 Electrode materials, types, design, wear ratio.
4.6 Manufacturing of electrodes.
4.7 Holding methods.
4.8 Setting and machining.
4.9 controls of machine setting aligning of job with electrode, adjustment of machine conditions.
4.10 Machining different type of dies such as forging, trimming, forming, blanking etc.

5. C. N. C. MACHINES (10 Lectures)

5.1 Meaning of C. N. C.
5.2 C. N. C. system.
5.3 Function of C. N.C. system.
5.4 Element of C. N. C. system.
5.5 How productivity is enhanced in C. N.C. machine tool.
5.6 Advantages of C. N. C. machine over conventional machine.

6. 3D PRINTING/RAPID PROTOTYPING (06 Lectures)

6.1 Principle
6.2 Working & Type

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Use of Workshop machines and video clip for better understanding of the subject
3. Assignments to promote problem solving abilities and develop continued learning skills.

MEANS OF ASSEESSMENT

−Assignments and quiz/class tests
−Mid-term and end-term written tests
−Small projects/WORKSHOP PRACTICE
−Viva-voce

RECOMMENDED BOOKS

1. A Text book of manufacturing Technology by R K Rajput, Laxmi Publications(P) Ltd
2. Production Technology by P C Sharma S Chand & Company Ltd
3. Production Engineering by P C Sharma S Chand & Company Ltd
4. Metal hand Bool Volume-III,By ASm Hand Book committee,American Society for metals
5. Workshop Technology, Volume-I,II,III By Chapman A.J.,Amol Publication,New Delhi
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	14	20
2	04	10
3	08	10
4	18	30
5	10	20
6	06	**10**
Total	**60**	**100**

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ENGINEERING DRAWING- II

Subject Code: 2.08

L	T	P
2	-	2

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.

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

DETAILED CONTENTS

1. OVER VIEW OF MASS PRODUCTION USING JIGS & FIXTURES.

(08 Lectures)

1.1 Principles of Jigs & fixture
1.2 Difference between Jigs & fixtures
1.3 Concept & function of locating elements, clamping elements, guiding elements & supporting elements
1.4 Design & Manufacturing process

2. **INTRODUCTION TO LOCATING ELEMENTS: (06 Lectures)**

2.1 Basic Principle of Location
2.2 Method of Location.
2.3 Flat, Conical jack pin, Drill bush, Fixed V locator, Sliding V locator, Outside pin locator, Diamond pin locator etc.

3. CONCEPT & CLASSIFICATION OF CLAMPING ELEMENTS : (06 Lectures)

3.1 Screw clamp. Flat, clamp, Pivoted clamp, Equilising clamp, Latch clamp, Swing plate clamp, Double acting clamp, Wedge clamp, Cam clamps

4. JIGS & FIXTURES: (16 Lectures)

4.1 Material and their treatment for Jigs & fixtures
4.2 Drawing of Jigs & fixtures
4.3 Open Jig
4.4 Box Jig
4.5 Plate Jig
4.6 Indexing Jig
4.7 Milling fixture
4.8 Fixtures for gear cutting & profile milling
4.9 Drill bushes
4.10 Free hand sketches of milling planning fixture & welding fixture

5 ASSEMBLY & PART DRAWING OF PRESS TOOLS : (16 Lectures)

5.1 Study of components, method for strip layout, economic factor & strip layout for optimization
5.2 Blanking tool
5.3 Progressive tool
5.4 Inverted tool
5.5 Compound tool

6 DRAWING OF BENDING (U&V), FORMING & DRAWING DIES. (08 Lectures)

Note- Minimum 1 sheet/topic should be prepared by students which is to be submitted for evaluation.

INSTRUCTIONAL STRATEGY

Teacher should show real model 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

− Assignments and quiz/class tests
−Mid-term and end-term written tests
−Small projects/WORKSHOP PRACTICE
−Viva-voce
−Drawing sheets/ Sketches

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. Geometrical & Machine Drawing By Bhatt N D, Charotar Publishing House Pvt. Ltd., Anand
6. Engineering Workshop Drawing By A C Perkinson,Pitman Publisher
7. Engineering Drawing & Design By Cecil Jensen & Jay helsel, McGraw Hill Book Company
8.E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR,Chandigarh.

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	16
2	06	16
3	06	16
4	16	16
5	16	20
6	08	16
Total	**60**	**100**

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BASICS OF INFORMATION TECHNOLOGY

Subject code-2.10

L	T	P
-	-	4

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)
-

DETAILED CONTENTS

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 Addresses, 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.
13. Auto CAD

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

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WORKSHOP PRACTICE-II

Subject Code: 2.09

L	T	P
-	-	**18**

II YEAR

6. ADVANCED SKILL IN MACHINE TOOL OPERATIONS BY MANUFACTURING DIFFERENT CUTTING TOOLS & MACHINE ELEMENTS

   a) Cylindrical & tool cutter grinding
   b) Special purpose tools for shaping, turning and milling
   c) Manufacturing of a twist drill
   d) Manufacturing of an end mill cutter
   e) Manufacturing of a spur gear

7. MANUFACTURING OF GAUGES

   a) Profile gauges
   b) Templates
   c) Plug gauges
   d) Ring gauges
   e) Snap gauges
   f) Taper plug gauges
   g) Taper ring gauges
   h) Thread plug gauges
   i) Thread ring gauges

8. MANUFACTURING OF JIGS

   a) Plate jigs
   b) Channel jigs
   c) Box jigs

9. MANUFACTURING OF FIXTURES

   a) Manufacturing of mandrels
   b) Turning fixtures
   c) Boring fixtures
   d) Milling fixtures

TOOL ENGINEERING - III

Subject Code: 3.01

L	T	P
3	-	-

RATIONALE

Working in plastic industry needs high grade skill, to convert the knowledge into reality and confidant to accommodate the fast changing design methods. Based on the process the performing professional varies, mainly Designer and Processing Technologist are the specialized key players. Other professionals include Plastic Testing Technologist, Plastic Mould Makers and the Mould designers. The Plastic Part designers who design Industrial and Consumer parts by using high end CAD System. Mould Designer plays a vital role who extras Core and cavity of the Part Design and Build Automatic Mould Design adding Runner, Ejection system etc. Before releasing drawing he finalizes the design by doing mould flow analysis which addresses Solidification, Mould temperature, Gating, Clamping and Injection pressure, Shrinkage and Draft analysis. He is a professional who knows the entire process of Know-how of plastic industry and perform his duties on CAD/CAE/CAM System. Plastic Mould Maker converts the Mould design into reality; it is a highly skilled and honored job in Tool Room, a set-up with team of professional who makes all kinds of Moulds and Dies in CAM and CNC. Mould maker is on-hand Professional who converts Know-how to Do-how and is one of the important factor in Indian industries.

LEARNING OUTCOME

- Study of various processes and machines used for plastic moulding
- converts the Mould design into reality
- Knowledge of injection and claiming pressure, cycle time, Mould temperature
- Perform Thermal tests like Specific heat, Thermal conductivity; linear coefficient expansion etc
- perform Electrical Testing as per requirement.
- studies and work on the science of polymer, more specifically raw material
- Knowledge of various machine used in plastic industry
- Know-how of plastic industry and perform his duties on CAD/CAE/CAM System

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DETAILED CONTENT

1. Introduction to Plastic (04 Lectures)

1.1 Definition
1.2 Overview of mass production of plastic components
1.3 Process of polymerization
1.4 Industrial application of plastic

2. Plastic Materials (10 Lectures)

2.1 Properties of plastic and its advantages
2.2 Classification of plastic materials

2.3.1 Thermoplastic plastics-properties, types & use
2.3.2 Polypropylene
2.3.3 Polystyrene
2.3.4 Polycarbonate
2.3.5 A.B.S (Acrylonitrile Butadiene Styrene)
2.3.6 Nylon
2.3.7 Polythene
2.3.8 Styrene
2.3.9 Cellulose acetate

2.4 **Thermoset Plastic Materials**

2.4.1 Classification of thermoset plastic properties, and uses
2.4.2 Phenolic plastic
3.4.3 Urea Plastic
2.4.4 Melamine Plastic

3. Introduction to Plastic Moulding Machine and process (15 Lectures)

3.1 Important part of injection moulding M/c and its function such as clamping, injection, ejection, feeding and heating.
3.2 Construction and main parts of a simple injection mould, advantage and disadvantage of injection moulding.
3.3 **Injection mould elements**- Core & cavity, feeding system, ejection system, cooling system.
3.4 Material for core and cavity, mould base, ejector pins, sprue bush, core and cavity retainer plate.
3.5 **Classification of injection mould-** Two plate mould, three plate mould stripper plate mould, hot runner mould and mould with side core.
3.6 Understanding three plate mould and hot runner system, feeding system, ejection system.
3.7 **Design parameter for Injection Mould-** Types of runners & gates, balancing of runners system, ejection system, heating & Cooling of mould, parting line shrinkage.
3.8 Injection mould defects & remedies.

4.0 Introduction to Compression Moulding Machine and process (10 Lectures)

4.1 Terminology used in compression moulding.
4.2 Parts and function of compression moulding M/c such as clamping, heating, feeding.
4.3 Construction of compression mould, and its parts.
4.4 Factor influencing compression moulding- temperature, pressure, cure time & vents.
4.5 **Types of compression moulds**- Positive mould, flash mould, & semi positive mould , open flash mould, closed flash mould.
4.6 Design parameter pertaining to mould, machine and material, quality & quantity requirement.

5.0 Introduction to Transfer Moulding Machine and process (10 Lectures)

5.1 Main parts and function of transfer moulding presses.

5.2 Construction and types of transfer mould- Pot type transfer mould, plunger type transfer mould and their application.

5.3 Design parameter of transfer mould, machine and material ,quality & quantity requirement.

6.0 Specification for mould, plastic material and machine. (04 Lectures)

7.0 Introduction to Moulding of threaded components (04 Lectures)

7.1 Designing of internal & external threaded mould components.

8.0 Multicolour moulding (04 Lectures)

8.1 Introduction and procedure

8.2 Sandwich injection moulding.

9.0 Introduction to blow moulding M/c and process (06 Lectures)

9.1 Parts and function of blow moulding m/c such as clamping, heating, ejection.

9.2 Classification of blow moulding m/c, function, parts and application.

9.3 Design parameter of blow moulds.

10.0 Introduction to thermo forming (04 Lectures)

10.1 Thermoforming equipments and process.

10.2 Classification and function of various thermoforming moulds and its parts.

11.0 Mould polishing, surface treatment and polishing technique. (04 Lectures)

INSTRUCTIONAL STRATEGY

1. Use of suitable models and real-life examples for better standing.
2. Apart from blackboard teaching, videos clips of process from industry be used for explanation of processes and machines involved

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Class room discussion
− Viva-voce

RECOMMENDED BOOKS

1. Blow Moulding handbook By Dominik V Rosato & Donald V rosato, CBS Publisher & Distributor,New Delhi
2. Injection Mould Design by R.G.W. Pye
3. Plastic Materials HandBook By A S Athalye, Multi Tech Publishing Co.,Mumbai
4. Moulding of Plastics By A S Athalye,Multi Tech Publishing Co.,Mumbai
5. Rubber & Plastic Technolgy, Chandra & Mishra, CBS Publisher & Distributor,New Delhi
6. Fundamental of Plastic Mould Design By S.K Nayak
7. Design of Blow Mould By R C Batra
8. Compression and Transfer Moulding of Plastics by James Butler
9. Handbook of Plastic Technology By Allen & Baker

10. 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	05
2	10	15
3	15	20
4	10	15
5	10	10
6	04	05
7	04	05
8	04	05
9	06	10
10	04	05
11	04	05
Total	**75**	**100**

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TOOL ENGINEERING – IV

Subject Code: 3.02

L	T	P
3	-	-

RATIONAL

This Diploma course requires an in-depth understanding of all the processes that requires use of tools, dies and molds and its underlying principles. Die casting and Forging processes involves use of variety of dies and tools and thus the need of this subject

LEARNING OUTCOME

1. Understanding of various die casting and forging processes, operations and their characteristics
2. A detail understanding of machines and equipment used during the process and their impact on die design requirements
3. Understanding of various die casting and forging die, die material, their types and characteristics
4. Enable students to understand and select the right die material, type of die and machine according to the die cast /forge component's material and complexity

DETAILED CONTENT

1. DIE CASTING (45 Lectures)

1.1. Introduction to die casting.
- 1.1.1. Gravity die casting.
- 1.1.2. Pressure die casting.
- 1.1.3. Advantages of pressure die casting.
- 1.1.4. Limitation of pressure die casting.

1.2. Introduction to die casting machines.
- 1.2.1. Cold chamber machines.
- 1.2.1.1. Vertical cold chamber machines.
- 1.2.1.2. Horizontal cold chamber machines.
- 1.2.1.3. Functions of cold chamber machines.
- 1.2.2. Hot chamber machines or Goose neck machines.
- 1.2.2.1. Function of hot chamber machines.
- 1.2.3. Comparison of hot and cold chamber process.

1.3. Die casting process
- 1.3.1 Design requirements for successful die casting.
- 1.3.1. Variables that determine the casting cycle time.
- 1.3.2. Terms relating to die casting and die casting dies.

1.4. Die casting dies
- 1.4.1. Die casting die elements.
- 1.4.2. Types of die casting dies.
- 1.4.2.1. Single cavity dies.
- 1.4.2.2. Multiple cavity dies.
- 1.4.2.3. Compound or combination dies or family dies, unit dies.

1.4.3 Materials used for die casting dies.
1.4.4 Concepts & Importance of cavity and core, runner and gates, over flow wells and vents.
4.4.5 Polishing of die casting dies and surface finish of castings.
1.4.5 Importance of heat treatment and polishing.

1.5 Major systems

1.5.1 Injection pressure systems.
1.5.2 Die locking systems.
1.5.3 Ejection system.
1.5.4 Cooling system.

6.1 Die casting alloys.

6.1.1 classification of die casting alloys
6.1.2 Zinc alloys.
1.6.2 Aluminum alloys.
1.6.3 Copper alloys.

1.7 Trim dies, types and uses. (0**2**)

2 FORGING (30 Lectures)

2.1 Introduction to Forging process (**12**)
2.1.1 hot working of metals grain flow.
2.1.2 Forging materials.
2.1.3 Temperature for forging.
2.1.4 Heating methods.
2.1.5 Furnaces.
2.1.6 Oxidization – burning of steel.

2.2 Forging operations. (**15**)
2.2.1 Hammer forging.
2.2.2 Drop forging.
2.2.3 Press forging.
2.2.4 Force, energy and power.
2.2.5 Different stages in forging operations. Puller, Blocker, Finisher.

2.3 Forging Dies (0**3**)
2.3.1 Die materials
2.3.2 Die types
2.3.3 Master making.
2.3.4 Finishing and polishing of forging dies.

INSTRUCTIONAL STRATEGY

1. Use of suitable models and real-life examples for better standing.
2. Apart from blackboard teaching, videos clips of process from industry be used for explanation of processes and machines involved

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Class room discussion
− Viva-voce

RECOMMENDED BOOKS

1. Production Engineering –P.C Sharma- S Chand Publication
2. Manufacturing Science- Ghosh & Mallik-
3. Forging Die Design & Practice, By R Saran,S N Prasad,N P Saxena ,S.Chand & Co.
4. Metal Working Science & Engineering, Edward M Mielnik,Mc Graw hill Book Co.
5. Manufacturing Process & Systems,Phillip F Ostwald & Jairo Munoz, John Wiley & Sons
6. Fundamentals of modern manufacturing –Mikell P Groover-Wiley student edition
7. Dies ,Moulds & Jigs,V Vladimi Rov,Mir Publisher
8. Forging hand Book, T G Byrer, American Society for Metals
9. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

Websites for Reference: http://swayam.gov.in
www.thelibraryofmanufacturing.com

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	03	4%
2	04	6%
3	08	10%
4	15	20%
5	07	10%
6	06	6%
7	02	4%
8	12	15%
9	15	20%
10	03	5%
Total	**75**	**100**

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QUALITY CONTROL

Subject Code: 3.03

L	T	P
3		

RATIONAL

Better products equal happier customers and higher revenue. Customers who buy products from your company will be expecting the same standard of quality each time they buy. Without a proper quality management system, your customers could find themselves buying the same product, but with various standards of quality. Quality control is important to safeguard the company's reputation, prevent products from being unreliable, and increase trust on the side of consumers. It ensures that the company looks at evidence-based data and research rather than anecdotal observations to ensure that the services/products live up to the standards

LEARNING OUTCOME

- The most important advantage derived by introducing quality control is that it develops and encourages quality consciousness among the workers in the factory which is greatly helpful in achieving desired level of quality in the product.
- Through Study of effective inspection and control over production processes and operations, production costs are considerably reduced.
- Quality control further checks the production of inferior products and wastages thereby bringing down the cost of production considerably
- Quality control ensures maximum utilisation of available resources thereby minimising wastage and inefficiency of every kind.
- Quality control brings about economies in inspection and considerably reduces cost of inspection.
- An effective system of quality control is greatly helpful in increasing the morale of employees, and they feel that they are working in the concern producing better and higher quality products
- By supplying technical and engineering data for the product and manufacturing processes, improved methods and designs of production are ensured by quality control.

DETAILED CONTENT

1. INTRODUCTION (08 Lectures)

1.1 Quality control and assurance.
1.2 Quality for effectiveness of organization.
1.3 Concept of inspection.
1.4 Principle of inspection.
1.5 Quality control.
1.6 Quality assurance.
1.7 Aiming the product to desired standards.
1.8 Find out the variation in manufacturing.

1.9 Final aim of inspection in any organization with chart.

2. INSPECTION STANDARDS (13 Lectures)

2.1 Inspection standard.
2.2 Classification of inspection standard.
(1) Inspection standard for raw material.
(2) Inspection standard for work in process.
(3) Inspection standard for finish product.
(4) Inspection standard of complete mechanism.
2.3 Type of inspection
1. Process Inspection
2. Floor Inspection
3. Centralized Inspection
4. Sampling Inspection
5. Operative or Stage Inspection
6. Final Inspection
7. Tool Inspection

3. QUALITY CONTROL (04 Lectures)

3.1 Introduction
3.2 Define the quality control.
3.3 Objectives of quality control.
3.4 Advantages of quality control.

4. QUALITY CONTROL FUNCTION (06 Lectures)

4.1 Customer quality analysis requirements.
4.2 Setting up the procedures for checking.
4.3 Detecting the departures from standards.

5. GENERAL QUALITY CONTROL ENGINEERING (10 Lectures)

5.1 Systematic training development methods of inspection and standards.
5.2 Causes for variation in process.
5.3 Chance variation.
5.4 Assignable causes variation.
5.5 Process capability.
5.6 Developments of quality consciousness.

6. PERFORMANCE AND ACCEPTANCE CONTROL (10 Lectures)

6.1 Performance control – introduction.
(i) Elementary idea of attributes charts

(ii) Elementary idea of index charts.

6.2 Acceptance control

(i) Introduction and objectives.

6.3 Concept of quality circle and control charts and applications (X bar chart, P bar chart and C bar chart).

7. STATISTICAL QUALITY CONTROL (06 Lectures)

7.1 Introduction.
7.2 Purpose and scope.
7.3 Presentation and analysis of data and tally sheets.
7.4 Tool of Quality Control

8. SAMPLING (12 Lectures)

8.1 Definition and explanation of the following terms with examples

(i) Production.
(ii) Sampling unit.
(iii) Random selection.
(iv) Probability.
(v) Sample size.
(vi) Number of sample.
(vii) Sampling distribution.
(viii) Random numbers.
(ix) Method of random selection.

9. INTRODUCTION TO ISO 9000, ISO 14000 (08 Lectures)

INSTRUCTIONAL STRATEGY

1. Teacher should use models and encourage students to develop some other suitable model.
2. The teacher should observe and redress the difficulties faced by students in performing the work while working on ergonomically good and poorly designed workstation.
3. The teacher should show them real forms to be filled from stores and record keeping.

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Model/prototype making
− Preparation of different charts
− Viva-voce

RECOMMENDED BOOKS

1. Inspection & Measurement in Manufacturing by William Winchel
2. Engineering Metrology,R K Khanna, Khanna Punblisher
3. ASM Handbook Volume 17,ASM International, ASM International
4. Metrology & Quality Control,S N Mahayan,N M Ambedker,Nirali Prakashan,Pune
5. Statistical Quality Control, M Mahajan
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	08	20
2	13	10
3	04	10
4	06	10
5	10	10
6	10	10
7	06	10
8	12	10
9	8	10
Total	**75**	**100**

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PLANT MAINTENANCE AND SAFETY ENGINEERING

Subject Code: 3.04

L	T	P
3	-	-

RATIONALE

A diploma engineer is involved in supervision and maintenance jobs. He must know the various processes carried out during testing, repair and maintenance. Hence this subject is very important for diploma students.

LEARNING OUTCOMES

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

- Understand the maintenance activity and its importance of maintenance department.
- Explain the concept of testing, repair and maintenance of machines.
- Students will learn the methods of recovery of wear out parts of machine.
- Explain about various lubrication system and get knowledge about different types of lubricants.
- Students will get the information of maintenance organization
- Students will get knowledge of safety precautions of machine and workshop.

DETAILED CONTENTS

1. INTRODUCTION (08 Lectures)

1.1 Brief concept of Tool Room machine maintenance and its meaning.
1.2 Types of maintenance and its advantages and disadvantages.

2. WEAR (10 Lectures)

2.1 Wear in machine and their causes.
2.2 Types of wear.
2.3 Defects due to wear in machine parts / equipments.

3. SERVICE OF MACHINE PARTS (10 Lectures

3.1 Brief description of service of machine parts by welding, electroplating, metal spraying, iron lining and adhesive bonding.
3.2 Consideration while selecting a method of recovery.

4. LUBRICATION (12 Lectures)

4.1 Lubrication principle.
4.2 Function of lubrication.
4.3 Types of lubricant and their specifications.
4.4 Selection of the lubricant.
4.5 Methods of lubrications.

4.6 Planning and scheduling of lubrication.

5. ORGANISATION OF REPAIR AND MAINTENANCE (08 Lectures)

5.1 Need of maintenance organization.
5.2 Function of maintenance department.

6. MAINTENANCE PRACTICE (15 Lectures)

6.1 Maintenance of hydraulics and pneumatics system.
6.2 Assembly and disassembly of machine parts like bearings, belts, pulleys, gears, clutches, couplings, gear – box etc.
6.3 Maintenance and reconditioning of hand tools such as marking tool, chisel, lathe tool, scraper, drill, files etc.
6.4 Maintenance of general purpose tool room machines like lathe, milling, shaper, grinding, drilling etc.
6.5 Concept of Total Productive Maintenance.
6.6 Industry 4.0 (Preventive Maintenance)

7. SAFETY ENGINEERING (12 Lectures)

7.1 Definition and importance of safety in industry.
7.2 Accidents and its analysis.
7.3 General safety devices used on machine.
7.4 Safety on tool room machines such as power hacksaw, band saw, drilling machine, lathe machine, milling machine, shaping machine, cylindrical and surface grinding machine.
7.5 Guarding of machines, basic requirement, types of guards.
7.6 General safety rules and precautions to be followed in material handling, working of machines, precaution against fire.
7.7 Industrial house keeping, proper lay out of machine and equipments.

INSTRUCTIONAL STRATEGY

1. Lay greater emphasis on practical aspects of maintenance.
2. Make use of transparencies, video films and CD's.
3. Expose the students to real life situation.
4. Promote continued learning through properly planned assignments.
5. Demonstrate sample of all types of gear and bearings.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Industrial Maintenance by HP Garg; S. Chand and Company, Delhi.
2. Installation, Testing and Maintenance by JS Narang, Dhanpat Rai & Sons, New Delhi.
3. Plant Maintenance Engineering by RK Jain; Khanna Publishers, Delhi.
4. Installation, Servicing and Maintenance by SN Bhattacharya; S Chand and Company, Delhi.
5. Maintenance Engineering and Management by RC Mishra and K Pathak; Prentice Hall of India Pvt. Ltd., New Delhi.
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	8	10
2	10	14
3	10	16
4	12	18
5	08	14
6	15	14
7	12	14
Total	**75**	**100**

INDUSTRIAL ENGINEERING

Subject Code: 3.05

L	T	P
3	-	-

RATIONALE

This Diploma course requires study of various engineering and management aspects of development of tools, dies and molds. Understanding the role of tools, fixtures and dies in productivity improvement and thus learning the tools of productivity improvement tools and techniques are essential

LEARNING OUTCOMES

This course, enable the students to-

- use industrial engineering concepts to improve productivity
- use resources optimally and economically.
- apply work study techniques for improving production
- prepare small networks for project management
- maintain inventory optimally and classify different types of inventories

DETAILED CONTENT

1. INDUSTRIAL ENGINEERING AND ITS APPLICATION (08 Lectures)

1.1 Overview of Industrial Engineering and application.

1.2 Concept of Industrial Engineering. Concept of system.

1.3 Concept of Men, Material and equipment. Industrial Engineering activities such as work study, plant layout and material handling, inventory control.

1.4 Principles of industrial engineering, production management system, resources, system evaluation, productivity and industrial engineering.

1.5 Development of industrial engineering and application of industrial engineering.

2. PLANT LAY OUT (08 Lectures)

2.1 Methods and procedure of plant layout.

(i) Over view of plant layout.

(ii) Concept of plant, plant location, factors governing plant location, plant layout, classification of plant layout and concept of work station.

(iii) Principles of plant location, plant layout, work station design, design of different plant layouts.

(iv) Explain methods of plant layout and procedure for making plant layout.

3. PRODUCTIVITY AND WORK STUDY (30 Lectures)

2.1 Productivity.

(i) Overview and influence of productivity.
(ii) Concept of productivity, factors affecting productivity, productivity measures.
(iii) Principles of productivity, productivity measurement, increasing of productivity.
(iv) Explain factors affecting productivity, resources for increasing productivity and kinds of productivity measures.

2.2 Method study
(i) Overview and application of method study.
(ii) Concept of work study, method study, micro motion study, symbols, concept of flow process chart, operation process chart, man-machine chart, simo chart, flow diagram, string diagram, motion economy.
(iii) Principles of work study, method studies, recording data, work selection, principles of examining the facts. Developed and improved method, installation and maintenance of improved method. Chart and diagrams used in method study, motion economy.
(iv) Procedure of method study and preparation of charts and diagrams.

2.3 Work measurement
(i) Overview and application of work measurement.
(ii) Concept of work study, Work measurement, Uses of time study, Time study methods, Time study recording, Methods of rating, Allowances and standard data, Work sampling.
(iii) Principles of work measurement, Time study methods, Allowances, Recording, determining standard data, rating techniques, work sampling.
(iv) Explain work measurement and technique of time study. Standard time, rating factors and performance rating, various allowances. Procedure for developing normal distribution curve (work sampling).

4. NETWORK ANALYSIS (15 Lectures)

4.1 Network analysis process.
4.2 Overview of network techniques of CPM & PERT (critical path method, project evaluation and review technique).
4.3 Concept of network analysis, classification of network technique. Concept of CPM & PERT technique.
4.4 Principle of CPM & PERT, time estimation in CPM & PERT.
4.5 Explain procedure to plan and control projects through CPM & PERT.

5. INVENTORY CONTROL (14 Lectures)

5.1 Control, models and application.
(i) Introduction and need for inventory and its control.
(ii) Definition, Re-order level, economic order quantity.
(iii) Principle of inventory carrying costing.

(iv) Study and observe the inventory of commonly used items.

5.2 Practice of inventory control

(i) Introduction and need of practice of inventory control.
(ii) Concept and classification of inventory control.
(iii) Principle of practice of inventory control.
(iv) Study and observe the practice of inventory control.
(v) ABC analysis, EOQ Model, Inventory Control with respect to cost reduction.

INSTRUCTIONAL STRATEGY

1. Apart from blackboard teaching ,use of related video clips and charts shall be used
2. Inter active Classroom exercises for preparation of various charts, layout of workplace and workstation
3. Classroom exercise for problem solving and preparation of network for analysis of project management
4. Exercises for filling of Real time forms from existing stores used for record keeping.

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Class room discussions
− Preparation of different charts
− Viva-voce

RECOMMENDED BOOKS

1. Work Study and Ergonomics by S Dalela and Sourabh
2. Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai and Sons, Delhi.
3. Industrial Engineering and Management by M. Mahajan; Dhanpat Rai and Sons, New Delhi.
4. Introduction to Work Study, ILO Publication
5. Production and costing by GBS Narang; Khanna Publishers, New Delhi.
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	8	10%
2	8	10%
3	30	40%
4	15	20%
5	14	**20%**
Total	**75**	**100%**

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PRODUCTION PLANNING, ESTIMATION & COSTING

Subject Code: 3.06

L	T	P
3	-	-

RATIONALE

Knowledge behind production planning, estimation, and costing is to ensure efficient and cost-effective manufacturing processes. It involves analyzing production requirements, estimating the resources needed, and determining the costs associated with producing goods or services. This helps businesses optimize production schedules, allocate resources effectively, and accurately calculate the overall cost of production. By implementing these practices, organizations can enhance productivity, minimize wastage, and make informed decisions to achieve profitability and competitive advantage.

LEARNING OUTCOMES

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

1. Understanding production planning: Students will grasp the concepts and principles of production planning, including capacity utilization, scheduling, and sequencing of operations.
2. Proficiency in cost estimation: Learners will acquire the skills to estimate the costs associated with various production processes, such as labor, materials, overhead, and equipment.
3. Knowledge of cost control techniques: Students will learn techniques and strategies to control costs throughout the production process, including identifying cost drivers, implementing cost reduction measures, and optimizing resource allocation.
4. Ability to analyze production requirements: Learners will be able to analyze production requirements and determine the necessary resources, including materials, labor, and equipment, to meet production targets effectively.
5. Understanding cost-volume-profit analysis: Students will comprehend the relationship between costs, volume, and profit and how changes in these factors impact decision-making within the production environment.
6. Competence in budgeting: Learners will develop skills in preparing production budgets, including estimating revenue, costs, and profit projections for a given period.
7. Application of production planning: Students will gain hands-on experience with production planning software tools, enabling them to effectively utilize technology for scheduling, capacity planning, and resource allocation.
8. Enhanced decision-making skills: Through studying production planning, estimation, and costing, individuals will develop critical thinking and problem-solving abilities required to make informed decisions related to production processes, resource allocation, and cost optimization.
9. Knowledge of lean manufacturing principles: Students will become familiar with lean manufacturing principles and techniques aimed at eliminating waste, improving efficiency, and enhancing overall productivity.
10. Effective communication and collaboration: Learners will enhance their ability to communicate and collaborate with cross-functional teams involved in production

planning and costing, fostering effective coordination and cooperation within the organization.

These learning outcomes equip individuals with the knowledge and skills needed to effectively plan, estimate, and control production costs, leading to improved efficiency, profitability, and competitiveness in manufacturing and service industries.

DETAILED CONTENT

1. INTRODUCTION (05 Lectures)

1.1 PRODUCTION AND ITS METHODS

1.1.1 To understand production and Methods of productions
1.1.2 Concept of production system, inputs, manufacturing process, output
1.1.3 Principle of production system, job production, batch production, mass production
1.1.4 Study of production system and method of production

2. PRODUCTION PLANNING (18 Lectures)

2.1 STORES & INVENTORY CONTROL

2.1.1 Overview of stores
2.1.2 Concept of storing, centralize and decentralize store, economical order quantity
2.1.3 Principle of store layout and store management.
2.1.4 Store and store function. Storing procedure. Documentation of store.

2.2 MATERIAL PLANNING

2.2.1 Overview of material planning and its importance.
2.2.2 Concept of material planning, master schedule, bill of material. Concept of inventory.
2.2.3 Principles of material requirement planning, operative cycle.
2.2.4 Study importance of material planning. Information required for material
Planning.

2.3 PROCESS PLANNING

2.3.1 Overview of process planning and a process sheet.
2.3.2 Concept of process planning, information required for process planning, economical sequencing, resources, quality control.
2.3.3 Principles of process planning, optimizing sequence of operations, resources, quality control
2.3.4 Preparation of working drawings. Selection of manufacturing process. Machine capacity & machine/equipment selection, operation planning &

tooling requirement, preparation of documents such as operation & route sheets

3. PRODUCTION CONTROL (18 Lectures)

3.1 ROUTING AND SCHEDULING

3.1.1 Overview of routing and scheduling phases of production control
3.1.2 Concept of Routing, scheduling, critical ratio scheduling, production control. Concept of charts
3.1.3 Principles of production control, scheduling, critical ratio scheduling, routing, generation of charts
3.1.4 Importance and objective of scheduling, manufacturing methods and scheduling. Use of control charts in scheduling

3.2 LOADING, DISPATCHING AND FOLLOW-UP

3.2.1 Overview of loading, dispatching and follow up process
3.2.2 Concept of loading, dispatching & follow up, job cards, progress card, auditing, value analysis
3.2.3 Principles of loading, dispatching & follow up, planning and re-planning, tooling and gauges, utilization of man, machine & material, delivery schedules
3.2.4 Procedure for loading, inspection, dispatching, follow up

4. ELEMENTS OF COST (14 Lectures)

4.1 COST STRUCTURE

4.1.1 Overview of cost elements and break even analysis
4.1.2 Concept of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost. Concept of break even analysis, graphical representation
4.1.3 Principles of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost. Principles of break even analysis, graphical representation
4.1.4 Explain various elements of cost, graphical diagram oaf cost structure, graphs of Break even point

4.2 OVERHEADS AND DEPRECIATION

4.2.1 Overview of allocation of overheads and depreciation
4.2.2 Concept of overheads, sinking fund method, depreciation, straight line method
4.2.3 Principles of allocation of overheads & Depreciation. selection of method
4.2.4 Procedure for calculating the overheads and allocation, calculating the depreciation cost

5. COST ESTIMATION (20 Lectures)

5.1 COMPONENTS OF JOB ESTIMATION

5.1.1 Application of cost estimation
5.1.2 Concept of estimate and cost, pricing, profit and loss
5.1.3 Principles of realistic estimates, proper selection of machines & other resources, cost comparison, cost, profit & loss

5.1.4 Explain various components of cost with reference to drawing. Describe components of job estimate

5.2 ESTIMATING PROCEDURE AND ESTIMATION OF COST OF COMPONENT

5.2.1 Overview of estimating procedure
5.2.2 Concept of reading drawings, manufacturing procedure, time estimation.
5.2.3 Concept of estimation of cost, material cost, overhead cost
5.2.4 Principles of estimation, raw material estimation, selection of process planning, time estimation, overhead expenses
5.2.5 List out elements of estimate, calculate the material cost, estimate time for each operation, add the overhead expenses. Find out the total estimated cost

INSTRUCTIONAL STRATEGY

1. Teacher should use models and encourage students to develop some other suitable model.
2. The teacher should observe and redress the difficulties faced by students in performing the work while working on ergonomically good and poorly designed workstation.
3. The teacher should show them real forms to be filled from stores and record keeping.

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Model/prototype making
− Preparation of different charts
− Viva-voce

RECOMMENDED BOOKS

1. Work Study and Ergonomics by S Dalela and Sourabh
2. Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai and Sons, Delhi.
3. Industrial Engineering and Management by M. Mahajan; Dhanpat Rai and Sons, New Delhi.
4. Introduction to Work Study, ILO Publication
5. Production and costing by GBS Narang,Khanna Publishers, New Delhi.
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	5	05
2	18	25
3	18	25
4	14	20
5	20	25
Total	**75**	**100**

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ENTREPRENEURSHIP & MANAGEMENT

Subject Code: 3.07

L	T	P
3	-	-

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. 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
- Know about various laws related to industry and labour

DETAILED CONTENTS

1. GENERAL CONCEPT OF INDUSTRY. (10 Lectures)

1.1 Its Origin, History & Types
1.2 Entrepreneurship-main characteristics
1.3 Types, Kinds of Industry
1.4 Single Ownership
1.5 Partnership
1.6 Co-operative Society
1.7 Private Limited
1.8 Producers-Cooperative Societies
1.9 Small Scale Industries

2. INDUSTRIAL LAWS, WAGES & INCENTIVES (25 Lectures)

2.1 Salient Features of Company Law
2.2 Labour Laws
2.3 Factory Act-1948

2.4 Industrial Dispute Act-1947
2.5 Customs & Excise Laws
2.6 Sales Tax Procedures
2.7 Law of Partnership
2.8 Industrial & Fire Insurance Procedures
2.9 Income Tax- Personal and Corporate (Rules & Regulations)
2.10 Wages and Incentives

2.11 Different Systems of payment of wages and incentives including Taylor's differential note system

2.12 Concept of Payment of Wages Act1936, Min Wages Act 1948, Workman Compensation Act 1923, ESI, EPF Etc. (Including amendments till date)

2.13 Laws related to association and Trade Union Act 1976, Industrial Dispute Act 1947, Control Labour Act

3. PERSONAL MANAGEMENT & INDUSTRIAL PSYCHOLOGY (08 Lectures)

1. Industrial Psychology meaning of Industrial Psychology
2. Its role in Promoting Industrial Efficiency, Personal interest working condition.
3. Measures for improvement in working conditions
4. Psychological effects of working conditions on workers
5. Labour Welfare

4. PURCHASE AND STORES ORGANISATION (MATERIALS MANAGEMENT) (08 Lectures)

a. Function of Purchase Department
b. Purchase Procedures
c. Various records connected with Purchase
d. Duties of Purchase Officer and Purchaser
e. Functions and Types of Stores
f. Store Procedures
g. Record Keeping
h. Physical Stock Taking
i. Inventory Control

5. SALES MANAGEMENT (04 Lectures)

a. Function of Sales Department
b. Sales Organization
c. Duties of Sales Engineers

6. PRINCIPLES OF BOOK KEEPING AND ACCOUNTS (06 Lectures)

a. Concept of ledger
b. Journal cash book etc.
c. Profit and loss account
d. Balance sheet
e. Income & Expenditure account etc.

f. Idea of accounting details

7. INDUSTRIAL PROJECT AND ITS APPRAISAL (06 Lectures)

a. Project proposal and its main objective and formulation
b. Benefit cost stream
c. Life span
d. Evaluation critical-net present values
e. Benefit its cost ratio and internal rate of return
f. Social rate of discount and shadow price depreciation and its method of calculation

8. SUPERVISION AND LEADERSHIP (08 Lectures)

a. Supervisors role in an organization
b. Concept of effective Supervision, towards work & people concept of achieving Target, Controlling cost, Cooperation improvement in work system, Motivation, Team Development, Discipline, Human Relation, Leadership Communication
c. Principles of qualification and qualities of Supervisor effective Supervision towards work and people
d. Supervisors activities, concept of daily schedule weekly schedule, monthly schedule, yearly schedule

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

− Assignments and quiz/class tests
− Mid-term and end-term written tests
− Industrial Visits/Seminars

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, S. Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by M K Garg
6. Industrial Engineering and Management By O.P Khanna, Dhanpat Rai Publication

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

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	25	25
3	08	10
4	08	15
5	04	05
6	06	05
7	06	10
8	08	15
Total	**75**	**100**

*ENVIRONMENTAL STUDIES

Sub. Code:- 3.08

L	T	P
2	-	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** **(06 Lectures)**

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

2. **Air Pollution** **(04 Lectures)**

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

3. **Water Pollution** **(08 Lectures)**

3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. **Soil Pollution** **(06 Lectures)**

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 Lectures)**

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level,

Different method of minimize noise pollution.

6. **Environmental Legislation** **(10 Lectures)**

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** **(10 Lectures)**

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain, Ecofriendly

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
− Practicals

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 ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons, New Delhi.
8. E-books/e-tools/relevantsoftware 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 (Lectures)	Marks Allotted (%)
1	06	10
2	04	10
3	08	20
4	06	14
5	06	14
6	10	20
7	10	12
Total	**50**	**100**

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WORKSHOP PRACTICE-III

Subject Code: 3.09

L	T	P
-	-	24

III YEAR

1. ROTATIONAL TRAINING IN SPECIAL PURPOSE MACHINES (SPM)

    a. Jig boring
    b. Jig grinding
    c. Die sinking
    d. Spark erosion
    e. Profile grinding
    f. Profile checking on optical profile projector

2. ROTATIONAL TRAINING IN VARIOUS DEPARTMENT

    a. Tool design
    b. Quality control
    c. Injection moulding
    d. Computerized Numerically Controlled machines

3. MANUFACTURING OF PRESS TOOLS

    a. Bending tool
    b. Progressive tool
    c. Compound tool
    d. Combination tool

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INDUSTRIAL TRANNING

After the Annual Exam, Student of **II and III year** will go for a 4/6 week training in an industry. It will be structured and supervised by the institution. Purpose of the visit is to give students an **exposé** of industrial setup and that of simple tools, instruments and the skill there in day to day use. Every student will submit the institution a report of his visit. The report will invariably contain the description of his observations about (1) Product/work (2) Processes involved (3) Tools and equipments used.

SEMINAR

(GROUP DISCUSSIONS, PRESENTATIONS AND EVALUATION)

Subject Code: 4.01

L	T	P
-	02	-

4. DESIGN OF PRESS TOOLS

    a. Types of presses
    b. Elements of press tools
    c. Shear & shearing dies
    d. Bending dies
    e. Forming dies
    f. Drawing and deep drawing
    g. Coining & embossing dies

5. FUNDAMENTAL OF CNC MACHINING

    a. Economy, advantages
    b. Typical machine elements
    c. Input media, i.e., tapes, discs, key board
    d. Feed back systems of positioning
    e. Measuring systems for axis
    f. Electronic elements of micro computer and logic gates
    g. Fundamentals of geometry and technology for programming
    h. Structure of programmes and examples for programming

6. DESIGN OF INJECTION MOULDS

    a. Introduction and properties of plastics
    b. Different processing methods and machinery
    c. Two plate and three plate injection mould
    d. Compression and transfer moulds
    e. Blow moulding
    f. Hot runner moulds

7. PRECISION MACHINES

    a. Jig boring, jig grinding
    b. Copy milling, die sinking
    c. Optical profile grinding
    d. Spark erosion
    e. Relieving lathe
    f. NC-machines

8. DESIGN OF DIE CASTING DIES

    a. Different process and machinery
    b. Die casting aluminium and zinc alloys
    c. Die casting dies-design
    d. Die casting dies with side cores
    e. Casting defect and its elimination

9. INDUSTRIAL TRAINING

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WORKSHOP PRACTICE-IV

Subject Code: 4.02

L	T	P
-	-	44

IV - YEAR

1. MANUFACTURING OF MOULDS & DIE

    1.1 Manufacturing of Hand Moulds
    1.2 Manufacturing of a Multi Cavity Injection Mould
    1.3 Manufacturing of a die casting die

2. ROTATIONAL TRAINING IN VARIOUS DEPARTMENT

    2.1 Tool design
    2.2 Quality control
    2.3 Computerized Numerically Controlled machines

3. INTRODUCTION TO 3D MODELING

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10. RESOURCE REQUIREMENT

(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 students.

(B) Equipment Requirement

LIST OF MACHINE/S AND EQUIPMENTS

S.No.	Machine	Model/Machine no./ Country Of Origin	Specification	
1.	EDM DECKEL DE 20-2 with Digital presetting and read out	G30-DECKEL-DE-20-2-250-01 West Germany	Traverse	X320,Y220,Z320
			Table	450x340
			Current Rating	30 Amps.
			Resolution	0.001 mm
			Accuracy	0.01 mm
2.	Precision Weiler primus lathe LZ-G	1766082/DN/90L/8/2S/2-220-01 West Germany	Swing Over Bed	245 mm
			Distance Between Centers	425 mm
3.	Universal Tool Milling Machine DECKEL FP1	2-235-01/2101/1815 West Germany		
			Resolution	0.001 mm
			Table Size	210 X 600 mm
4.	Combined Jig Boring & Grinding Machine with digital presetting and read out on 3 axes and circular table	DECKEL LKD/S /2304/ West Germany	Table	650X300 mm
			Work Area	540X270
			Traverse	X 400 Y 254 Z 340
			Resolution	0.001 mm
			Circular Table	305 dia
			Resolution	1 sec.
			Max. Job Weight	150 Kg.
5.	Deckel FP4AB	2-235-02		
6.	CNC Contour Universal Milling & Boring Machine with automatic functions & controlled cycles	Deckel FP4A /2-235-03/ West Germany	Table	710-430
			Traverse	X430,Y385,Z380
7.	Bed Type Milling Machine Botliboi	BMV-75/008/ India	Bed L x W	1470 X 630 mm
			Traverse X	1000 mm
			Y	600 mm
			Z	630 mm
			Throat Min/max Job Height	20 / 780 mm
8.	Universal Milling Machine	HMT-FN2U/2-230-03/India	Table Size	310 X 1350 mm
9.	Turret Ram Type Milling Machine	HMT-M1TR/ 2-230-04/ India	Table Size	230 X 1070 mm
10.	Universal Copy Milling	DECKEL KF-2 /2-230-06/ West Germany	Pantograph Ratio	1:4,3,2½,2,1½,1
			Cutting Area	410 X 450 mm
11.	High Speed Precision Lathe	Kirloskar Enterprise 2215/2-220-05/India	Swing in gap of 230	830 mm
			Swing Over Bed	560 mm
			Swing over cross-slide	375 mm
			Distance between centers	1500 mm
12.	Radial drill	HMT RM 63/2-250-01/India	Capacity in steel	60 mm
13.	Hydraulic press	NEFF E2P63/2-250-07/West Germany	Capacity	63 T
			Table	630 X 680 mm
14.	Surface & Profile Grinding Machine	JUNG/ 2-240-01/West Germany		
15.	Universal Cylindrical Grinding Machine	OVERBECK 400 RU/ 2-245-02/West Germany	Max. Job Dia.	100 mm
			Max Job Length	400 mm

16.	Surface & Profile Grinding Machine	ELB-HK Orion 755 ND /2402-12-240-03/ West Germany	Table	450 X 1100 mm
			Max Job Height	500 mm
			Traverse	X 725, Y 465
17.	Filing Machine	MICROTECH/ India	Throat Depth	200
			Throat Clearance	80
			Table Size	300
			Strokes/Min	315/400
18.	Grinder Horizontal	5-210-01		
19.	Grinder Vertical	1-240-04		
20.	Tool Cutter Grinder	PRAGA 411 / 1-240-03 / India	Max. swing over centers	200 mm
			Max. Distance Between Centers	475 mm
21.	Cylindrical Grinding Machine	HMT-GTC K 130-500 U / 1-245-02/ India	Max. Job Dia.	125 mm
			Max Job Length	550 mm
22.	Surface Grinder	ALEX model 750 CF / NH 750-1-240-01 / India	Long Travel	800 mm
			Cross Travel	280 mm
			Centre Height	425 mm
23.	Pantograph 3 Dimensional Milling Machine	1-230-07/ India		
24.	Lip Grinding Machine	1-250-16		
25.	Universal Milling Machine with D.R.O.	Kunzman UF 8/3 /1-230-03 /West Germany	Table Size	315 X 1000 mm
26.	Horizontal Milling Machine	Pioneer /UO-750/ India		
27.	Tool Grinder MULTIHEAD	Solid /2-250-22		
28.	Shaping Machine	COOPER CSM / 1-225-01/ India	Stroke	450 mm
			Traverse – Horizontal	550 mm
			Traverse – Vertical	300
29.	Pedestal 071068	NA		
30.	Power Hacksaw	KOBRA-9 /87-9H-C-1493/ India	Round Dia Cut	225 mm
			Square Size Cut	200 mm
31.	High Speed Precision Lathe	KIRLOSKAR ENTERPRISE 1675/1-220-01/ India.	Swing In Gap of 155	585 mm
			Swing Over Bed	400 mm
			Swing over cross-slide	245 mm
			Distance between centres	1500 mm
32.	High Speed Precision Lathe	GEMA / LZ-170-903-6670-1-220-02/ West Germany		
33.	GEEDEE WEILER Lathe	LZ -245-B/G 1-220-05		
34.	GEEDEE WEILER Lathe	1-220-04		
35.	Colum Drilling Machine	EIFCO PL 25 PZ/25/GT/A/20/1035/82/ India		
36.	Table Drilling Machine	EIFCO BDM/RC / 12MM / 0263/82 / India	Capacity In Steel	12 mm
37.	Metal Band Saw	ALLWYN LHS – 36/1-250-08/ India	Throat	915 mm
			Job Height	305 mm
			Table	660 X 660 mm
38.	Colum drill Ixion	1-250-10		
39.	Table Drilling Machine	EIFCO BDM/RC /5-210-02/ India	Capacity In Steel	12 mm
40.	Solid Bench Drilling Machine	2-250-03		
41.	Ixion 50 Column Drilling Machine	2-250-02		

Sr.No.	ITEM NAME WITH BRIEF SPECIFIECATIONS	Qty.	Rate(Rs.)/ Unit
1	Desk cum chair	75	6500.00
2	Ultra-Short Throw Projection System with Interactive capability for Smart Classrooms	2	160000.00
3	Language Lab-software, Hardware & Furniture etc.	1	3000000.00
4	Desk top Computer	73	75000.00
5	Computer table	106	6440.00
6	Computer chair	95	8000.00
7	Trainer's table	10	8500.00
8	Trainer's chair	10	4500.00
9	3D Printer Maximum Printable Area	1	3000000.00
10	3D Scanner	1	3000000.00
11	Pillar Drill Machines -1"capacity	1	400000.00
12	Tabletop Drill machine - ½" capacity	2	175000.00
13	Pedestal grinder machine – Wheel Dia. 180mm	1	40000.00
14	Conventional Lathe Mc with accessories – Swing Dia. 250 mm	2	1200000.00
15	Conventional Vertical Milling Mc with accessories – Travel 400mm x 250	2	1250000.00
16	Conventional Universal Milling Mc with accessories – Travel 400mm x 250	2	1200000.00
17	Conventional surface Grinding Machine – Stroke length 400mm	2	1600000.00
18	Universal Tool & Cutter Grinder Machine – Wheel Size 150mm, Stroke 400mm	1	800000.00
19	Cylindrical Grinding Machine – swing dia. 125mm	1	1350000.00
20	Tabletop CNC Lathe (Trainer Type) – swing dia. 50mm	1	1650000.00
21	Tabletop CNC Milling(Trainer Type) – travel X – 150mm, Y-75mm	1	1650000.00
22	CNC Simulator (Fanuc, Siemens, Heidenhain)	5	1880000.00
23	CNC Lathe	1	2000000.00
24	CNC Milling	1	3000000.00
25	Z NC EDM	1	1200000.00
26	CNC WEDM	1	2800000.00
27	Hand Operated Hydraulic Press Machine – 5 Ton	1	100000.00
28	Micro Molding Machine	1	100000.00
29	Band Saw Machine	1	1000000.00
30	Cutting Tools	1	1094000.00
31	Measuring Instruments	Lot	5000000.00
32	Software Auto CAD	1	500000.00
33	Master Cam 10 user	10 user	1200000.00
34	Library Books	Lot	400000.00

BASICS OF IT LABORATORY/COMPUTER LABORATORY		
Description	Qty	Total Price (Rs.)
Computer System with latest configuration	30	8,00,000
Printer (MFP)	1	25,000
Printer (Laser)	1	35,000
Plotter	1	75000
Digitizer	1	50,000
Antivirus Software	L.S.	10,000
Internet Facility on Computers	L.S.	2,00,000
LCD Projector	1	35,000
UPS	60	1,20,000
Software (latest windows, latest MS Office)	1	1,00,000
Scanner	1	10,000
Auto CAD	L.S.	
Primavera/MS Project	L.S.	
Miscellaneous	L.S.	

ENVIRONMENT STUDIES LABORATORY			
Description		Qty	Total Price (Rs.)
1	Ph Meter	01	500
2	Turbidity Meter	01	5000
3	Oven with Temperature Controller and Forced Air Circulation Type	01	20,000
4	B.O.D. Incubator	01	25,000
5	Water Analyses Kit	01	5000
6	High Volume Sampler	01	40,000
7	Electrical Balance for weighing upto 1/10 of milligram (capacity)	01	1000

Furniture Requirement

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

- Furniture for laboratories / Computer Centre tentative estimate Rs. 15lacs

11. EVALUATION STRATEGY

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 theirindividualandprofessionalneeds.Evaluationalsohelpsindiagnosinglearningdifficulties 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 lacunais 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.

STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

I. Theory
II. Practical Work(Laboratory, Workshop, Field Exercises)
III. Project Work
IV. Professional Industrial Training (Field Exposure)

Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability 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 insection -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	10-30percent
Comprehension	40-60percent
Application	20-30percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Up to10percent

A. 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 weightage stop performance on task, quality of product, general behavior and it should be followed by viva-voce.

B. Project Work

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, learnt knowledge and skills in solving reallife 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 andqualityof presentation followed by viva-voce.

C. Professional Industrial Training (Field Exposure)

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 behavior, 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 behavior 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 up to grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.

3. HOD of every Programme Department along with HODs and in charges 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 practical, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical 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 stepsfor 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 planin 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 feedback to every student

8. The student centered 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 deliverybased conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations forimparting 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

List of experts who contributed in the revision and to develop the curriculum for The Four Year Diploma in **'Tool & Mould making'** as per NSQF in the workshop held on 18-04-2023 at Institute of tool room Training U.P. A-1 ,Amousi Industrial area Kanpur Road Lucknow .

1.	Shri Rajeev Sharma	Associate vice President, J.B.M. Group (Industry Expert)
2.	Shri Pradeep Kumar	HOD, Mech. Engg. Govt. Poly. Lucknow
3.	Shri Anil Bharti	Sr. Lecturer Electronics Engg. Govt. Poly. Lucknow
4.	Shri Anil kumar	Lecturer, Mech. Engg. Govt. Poly. Lucknow
5.	Shri P.S. Kuswaha	Lecturer, Mech. Engg. Hivet Poly. Lucknow
6.	Shri B.K. matin,	Chief Manager (Rtd.), Scooter India Ltd.
7.	Shri S.K. Sukla	Personnel Manager (Rtd.), Scooter India Ltd.
8.	Shri Arvind Kumar	Guest Lecturer, Institute of tool room Training U.P.
9.	Shri Santos kumar Patel	Sr. Engineer Training, Institute of tool room Training U.P.
10.	Shri Ajay Pratap Singh	Assistant Training, Institute of tool room Training U.P.
11.	Shri Gaurav Kishor Kanaujiya	Assistant Professor, I.R.D.T. Kanpur
12.	Shri Syam Lal	Course Coordinator, I.R.D.T. Kanpur
13.	Shri Monit Kumar	Technical Assistant, I.R.D.T. Kanpur

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